HOUSE OF LORDS

SESSION 1990–91
2nd REPORT

SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY

INTERNATIONAL SCIENTIFIC PROGRAMMES

VOLUME I—REPORT

Ordered to be printed 12 February 1991

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(HL Paper 24-I)

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SECOND REPORT

12 FEBRUARY 1991

By the Select Committee appointed to consider Science and Technology.

ORDERED TO REPORT:

INTERNATIONAL SCIENTIFIC PROGRAMMES

PART 1: BACKGROUND

CHAPTER 1: PREFACE

1.1 The Committee has conducted an inquiry into "how the United Kingdom responds to proposals for international scientific programmes".[1]

1.2 The Committee embarked upon its investigation following allegations that the United Kingdom's arrangements for responding to such proposals were deficient. As the Royal Society said in their written evidence to the Committee, "We are not aware of any single mechanism to prepare a United Kingdom response for proposals for ISPs. This absence of clear procedures can lead to delays in responding, giving the impression to the international community (yet again) of British reluctance to take a role in international co-operation". There was "a procedural vacuum in the United Kingdom for assessing declared international programmes ...". (Royal Society pp 56, 58). (The Committee considers the validity of this assertion and others like it in Chapter 7.)

1.3 In embarking upon this inquiry, the Committee has interpreted "response" to mean primarily the decision making machinery for response. But we have also considered certain policy consequences of participation (principally budgetary) which affect the quality of the United Kingdom's response in a broader sense.

1.4 We have concentrated on civil science, which includes engineering and technology. Moreover, we have elected neither to judge the validity of past decisions on participating in these programmes nor to comment on the value of current individual programmes. These are matters for the scientific community itself to determine.

1.5 International scientific programmes can take many different forms. These forms meet different kinds of scientific need, carry their own advantages and disadvantages, and give rise to different kinds of problem—whether in setting them up or carrying them out. The Committee begins, therefore, by considering briefly in Part 1 the different kinds of programme and the advantages and disadvantages they bring. We then look more closely in Part 2 at the problems encountered in the United Kingdom in responding to the different kinds of programme. Finally we consider in Part 3 the secondary, and principally budgetary and financial, problems that certain kinds of collaboration bring in their wake.

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[1]A list of the members of the Committee and its Specialist Advisers is printed as Appendix 1. The Committee met 16 times, heard oral evidence from 22 witnesses or groups of witnesses and received written evidence from 83 bodies. A list of witnesses is printed as Appendix 2 and the letter of invitation sent to witnesses is printed as Appendix 3. The Committee visited Bonn and Paris and a list of organisations visited may be found at Appendix 4. A glossary of acronyms is at Appendix 5 and notes on some of the principal programmes in which the United Kingdom participates are set out in Appendix 6.

CHAPTER 2: WHAT ARE INTERNATIONAL SCIENTIFIC PROGRAMMES?

2.1 As befits a major centre for science, the United Kingdom participates in international programmes of all kinds, ranging from the informal exchanges of individual scientists on the one hand to participation in treaty-based large international facilities with big budgets on the other. A description of some of the principal programmes involving the UK, arranged alphabetically, may be found at Appendix 6.[1] The variety of the collaborative programmes is considerable but for the purpose of lending a greater degree of coherence to our report, which is mainly directed to the machinery of response, we have identified three principal groups based on the degree of formality and commitment involved:

> *informal and personal programmes and projects* which are managed by the individuals concerned, save perhaps at the very outset, and do not on the whole have any financial implications which extend beyond existing resources;
>
> *formally co-ordinated multi-centred programmes* which are organised by existing umbrella organisations and which may or may not be funded by them. This category includes EC programmes;
>
> *large centralised programmes and facilities* which, whatever the bureaucratic arrangements they adopt, invariably require a decision as to funding by the United Kingdom government or its agencies.

2.2 Sir David Phillips, Chairman of ABRC, identified five categories of collaboration—individual collaboration; programmes which are essentially co-ordinations of research council activities under the wing of international bodies; bilateral agreements between the research councils and their opposite numbers abroad; multilateral enterprises dependent upon international agreements; and EC programmes (Q 609). The Committee's classification, though less detailed, covers projects in all his categories.

Informal and Personal Programmes

2.3 Few scientific programmes of work can flourish without effective contact with colleagues doing similar work, be it in this country or overseas. As science is, by its very nature, international it is only to be expected that so many of these contacts are themselves international. At its simplest the contact might be entirely personal—by correspondence, or by membership of a communication network. It might include attendance at conferences or a loose voluntary co-ordination of research on a specific theme. As the Secretary General of the European Science Foundation put it, "International journals and conferences and electronic interchanges of course provide much of what is required—scholars do not need to wander across Europe with begging bowls or knapsacks to find out what is happening in other universities ..." (ESF pp 311–314). Concern with programmes which give rise to organisational issues should not obscure the significance of purely individual relationships like these in developing international science.

2.4 The means of initiating such collaborations are straightforward. Normally, scientists know one another, by reputation at least, from the scientific literature and personally through conferences. The degree of common interest can be readily established. It is then up to the individual to apply to the relevant Research Council or any other available source for a grant to cover both the work and the travel involved, while the partner in the collaboration takes parallel action in his own country. The ability of United Kingdom scientists to engage in personal collaborative projects of this kind depends critically on a healthy research base at home and "well-found" laboratories at the universities. The Committee received evidence on a variety of organisations which help to promote this kind of collaboration.

2.5 *International Council of Scientific Unions and the Royal Society*: The International Council of Scientific Unions (ICSU) is a world-wide organisation of national societies or academies of

[1]Definitive guides for United Kingdom scientists and engineers to collaboration in science and technology include "European Collaboration in Science and Technology: A guide for the United Kingdom scientist and engineer", 1987, published by the Science and Engineering Policy Studies Unit (SEPSU) of the Royal Society and the Fellowship of Engineering. This compendium (currently under revision) provides a starting point for scientists wishing to participate in collaborative R&D between the United Kingdom and other European countries both within and outside the European Community. European Community programmes are covered more exhaustively in "EC Research Funding: A Guide for Applicants", 2nd edition, 1990, published by the Commission of the European Communities.

scientists. The "adhering body" for the United Kingdom is the Royal Society. The Council operates through twenty Unions or Scientific Committees representing different specialisations and the United Kingdom is a member of nineteen of these. The principal activity of the Unions is to arrange conferences, communications networks and "International Year" projects for co-ordinated research on specific matters. There is a small secretariat in Paris.

2.6 The Royal Society's role through its specialist committees is to assess on behalf of the United Kingdom the potential of, and scope for participation in, these international programmes and then to stimulate interest in them. Scientists wishing to participate in ICSU programmes must seek funding from the Research Councils in the usual way, however. The Royal Society runs an information office to ensure that details of international programmes promoted by ICSU are known to the United Kingdom scientific community, "in order to make known the opportunities for research and for the exchange of data, results and ideas that are often the seedcorn of new collaborative ventures" (pp 58–59).

2.7 *British Council*: One of the British Council's functions is to provide access for the rest of the world to the best of British science and research. The Council's principal ways of doing this are through funding interchange of persons, providing library and information services and facilitate S&T projects on behalf of ODA and multilateral donor agencies like the EC or World Bank. Most of this work is co-ordinated bilaterally. The Council does not fund research in its own right and expects successful collaborative work and relationships to be self-sustaining after about three years—either with Research Council or EC funding. The Council maintains science-qualified staff in some 39 countries and is well placed to offer advice on the ground to visiting scientists.

2.8 The Committee received detailed evidence describing a wide range of interchange schemes funded by the British Council—like the Visitors and Fellowship Schemes which funded 689 fellowships and 935 visits to the United Kingdom in 1989–90. The Council also organises self-financing specialist courses in the United Kingdom for overseas scientists. It administers the Foreign and Commonwealth Office Scholarships and Awards Scheme, which supported 925 visits to the United Kingdom by scientists in 1989–90; and the Commonwealth Scholarship and Fellowship Plan on behalf of ODA and FCO, which supported 890 people in the same period. Its principal work for science on behalf of ODA has been in administering the Technical Co-operation Training Programme which funded 6119 training placements in 1989–90, and the Academic Link Programme, currently assisting institutions of higher education in over 50 developing countries (pp 25–6).

2.9 Outward visits feature less prominently in the British Council's work, and principally consist of the Specialist Tours or Travel Grants to meet requests from overseas for visits from United Kingdom scientists. The Council has recently (usually in collaboration with the research councils) started science research collaborations promoting academic contacts with specific countries. An Anglo-Spanish programme, the Acciones Integradas scheme, started in 1983 was the pioneer but similar programmes with France (Alliance) and Germany (ARC) have followed (p 25; Shore p 358; McCleverty Q 889).

2.10 *European Science Foundation*: The European Science Foundation (ESF), based in Strasbourg with a secretariat of 20 and a budget of £5m per annum, is an association of national research councils and academies in 19 Western European countries. Its principal role is to link research which is supported by its member councils and academies. It promotes some 40 programmes or networks of scientists in pursuit of common goals. It sees itself as a catalyst for co-operation in basic science. Indeed, personal exchanges through ESF actually laid the intellectual foundation for the establishment of a large facility—European Synchrotron Radiation Facility (ESRF) at Grenoble. The initial planning was also performed by the ESF.

2.11 *Royal Society*: The Society does much to foster international exchange and collaboration in science. A major part of this work is now done through exchange programmes with national academies or similar scientific bodies overseas; more than 1000 scientists annually move to or from the United Kingdom under 44 formal agreements and a number of informal arrangements. The programmes may involve postdoctoral level fellowships lasting between 6 months and 2 years and study visits usually lasting between 2 weeks and 6 months. The major international exchange programmes are the European Science Exchange Programme (ESEP) involving 19 countries (including the United Kingdom) in Europe; exchange agreements with academies in eastern Europe and the USSR (a programme progressively being integrated with ESEP); the China

Programme involving agreements with a number of Chinese scientific bodies; programmes of exchanges with Japan, India, Australasia, Canada and Egypt, and with countries in Latin America, Africa and South-East Asia; and the Developing Countries Fellowship Scheme which funds scientists from developing countries. The Society also provides grants to British scientists. The most important scheme is the Travel Grants Programme for conferences or short visits to institutions overseas by British scientists (providing funds for about 1700 scientists per year). In addition, Overseas Field Research Grants are awarded for the expenses of British scientists undertaking field work overseas (about 20 awards per year); Guest Research Fellowships meet the expenses of eminent overseas scientists invited by a British scientist (20 awards per year); and Grants for International Meetings in the United Kingdom assist British scientific conference organisers, hosting major international conferences (32 awards made in 1990).

2.12 *North Atlantic Treaty Organisation*: The NATO Science Programme supports co-operation and information exchange between about 10,000 scientists of Alliance nations each year. Under the fellowship scheme, some 70 United Kingdom nationals study abroad and 200 NATO nationals study in the United Kingdom. Research grants are also available for up to two years of post-doctoral study, and travel and subsistence grants are available for short reciprocal visits by collaborators on special projects (Queen's Belfast p 354). In addition NATO promotes workshops and study institutes, and helps to pay participants' costs.

2.13 Other informal groupings have arisen in recent years with similar objectives to ICSU and ESF, like "the Anglo-Franco-German grouping on transition metal proteins; a committee on nuclear (medium energy) physics (NUPECC); in mathematics EUROMATH; in general chemistry the Committee of European Research Council Chemistry Committee Chairmen (CERC 3); and in materials". SERC thought highly of this form of co-ordinated action as a means of initiating and developing international collaboration (p 73). These groupings mostly have no fixed secretariat and no budget available; they are run informally by one or two of the participants.

Formally co-ordinated multi-centred programmes

2.14 The formally co-ordinated multi-centred programme differs from the informal and personal category in that its programmes are formally co-ordinated, and the scientific work is geographically spread out in the participating countries or their installations, rather than centralised in large facilities. A number of different kinds of programme can be identified. They fall into two categories—those which rely on participant bodies to meet the cost of their co-operation in the programme and those which are assigned a centrally managed direct budget.

2.15 Programmes which rely on participants to meet the costs of their collaboration include:

- those promoted by inter-governmental organisations (IGOs) as umbrella bodies—like the UN and its agencies, or the OECD's International Energy Agency;
- those promoted by non-governmental organisations (NGOs) like ICSU;
- agreements for sharing facilities initiated by government agencies or research councils;
- EUREKA, industrially funded with, in some cases, contributions from member governments.

Programmes which are assigned their own funds include:

- those funded out of the research budgets of IGOs like the UN and WHO;
- the Human Frontiers Science Programme set up by Japan;
- the EC Framework Programme and its constituent programmes.

2.16 The Committee received extensive evidence on the various kinds of multi-centred ISP in which the United Kingdom currently plays a role (DES pp 122–129; SERC pp 72–77; Royal Society pp 59–60; NERC pp 93–100; DTI pp 109–113; DEn pp 160–7; AFRC p 273; MRC pp 208–9). Many of these programmes are set out by category in Appendix 6. We refer to some of them here to illustrate the diversity of their origins and organisation.

2.17 Inter-governmental organisations have promoted a number of multi-centred research programmes, in particular the United Nations and its agencies. Thus under the aegis of the Inter-Governmental Oceanographic Commission (IOC), a UN body, the United Kingdom's Proudman Oceanographic Laboratory takes part in the Permanent Service for Mean Sea Level (PSMSL) and the Global Sea Level Observing System (GLOSS); the UK's Institute of Hydrology takes part in the International Hydrology Programme; and the British Antarctic Survey and the Meteorological Office take part in the World Weather Watch programme of the UN World Meteorological Organisation (NERC pp 93–94).

2.18 The International Energy Agency (IEA) and the Nuclear Energy Agency (NEA), both OECD bodies, act as umbrella organisations for various research projects in the energy field. Indeed, the Department of Energy found the IEA NEA mechanism a particularly favourable way of setting up collaborations on an "a la carte" basis (Q 485). NATO and the Antarctic Treaty System also organise programmes in which NERC collaborates (p 88).

2.19 Non-governmental organisations like ICSU and ESF can also play a part in promoting programmes which go beyond the purely personal. ICSU, jointly with the WMO, sponsor the World Climate Research Programme. The United Kingdom is much involved in experimental projects under this programme—like the Global Energy Water Experiment (GEWEX) and the World Ocean Circulation Experiment (WOCE). The United Kingdom also takes part in the International Geosphere-Biosphere Programme (IGBP). In particular, the United Kingdom's own Biogeochemical Ocean Flux Study (BOFs) forms part of the Joint Global Ocean Flux Study (JGOFs) (NERC pp 95, 126).

2.20 Agreements between research councils or government agencies and their overseas counterparts are also common, usually involving a Memorandum of Understanding (MOU) between the collaborating parties. Such arrangements can be bi-lateral or multi-lateral. For example, AFRC informed the Committee that their international programmes mainly took the form of bi-lateral links with overseas laboratories. Such bi-lateral programmes exist with France, Spain, the Netherlands, Australia and New Zealand and the National Science Foundation of the USA (on mapping the Arabidopsis genome) (AFRC pp 272–5). EUROMET, which aims to formalise co-operation between national metrology institutes and was initiated by the Unnited Kingdom, has by contrast no fewer than 18 participants (p 110). The sharing of ship time through NERC's participation in the International Research Ship Consortium is another example (p 95).

2.21 Industrial collaborative research is promoted at European level by the EUREKA programme. The EUREKA programme and the EC Framework Programme (see para 2.25 below) are meant to be complementary. EUREKA is meant to be concerned mainly with near market R&D while the Framework Programme is supposed to focus on pre-competitive research (p 110). EUREKA, though set up as a Franco-German initiative in 1985, is not an EC institution; its membership includes EC and EFTA countries and Turkey. Unlike the Framework Programme which is based on jointly agreed long-term specific aims, EUREKA projects are meant to be spontaneous and industry-led. The DTI does much to promote the EUREKA mechanism for collaboration amongst United Kingdom companies. EUREKA status for an industrial collaboration brings no money in itself but member governments can provide financial support to their own participants from their national schemes. Indirectly such funding benefits all the collaborations in the scheme. Currently, annual spending from all sources on EUREKA projects amounts to about 1 bn ecu (£670m), though this varies each year as projects change.

2.22 Co-operation in government funded research at European level is promoted by a body called COST (which stands for European Co-operation in the field of Scientific and Technical Research). COST is an organisation set up in 1971 to promote scientific co-operation between EC, EFTA and European OECD countries. Proposals for collaboration—which are effectively a co-ordination of national efforts—are put forward through government departments of member states. If a project is approved and at least three states wish to take part, participants sign a Memorandum of Understanding. While planning is carried out jointly, funding remains national. COST promotes no specific programmes but functions "a la carte".

2.23 The United Kingdom Cabinet Office takes a strategic view of international collaboration. We were told by the Chief Scientific Adviser that they felt that European collaboration has been too focused on EC Commission programmes to the neglect of bilateral relationships and were currently promoting bilateral collaborative projects with France, Germany and Japan. A series of continuing round tables of officials had been initiated with the Japanese involving all the United

Kingdom Research Councils. A number of projects had been established. Similar meetings were proposed with France and Germany. Collaboration with the US, it was thought, was less in need of "a particular push" (Q 162).

2.24 Multi-centred international programmes in possession of their own money are relatively few and far between. UN and WHO agencies have research budgets of their own and the work is most often both led and carried out by their own laboratories, often sited in developing countries. They may make funds available for travel to those centres and sometimes for research contracts directed to their programmes. (The Committee have received no evidence relating specifically to these programmes.)

2.25 The Human Frontiers Science Programme directed by Sir James Gowans was established as a result of a Japanese government initiative with a funding of $17m in the first year. Other countries have, however, been slow to contribute further funds. So far, France has contributed $1m and Italy $0.8m. The Programme operates in areas determined by a scientific committee which includes United Kingdom scientists (QQ 676–668).

2.26 The Framework Programme is a significant source of funding for research money in the United Kingdom. It has already been the subject of detailed study and report by the Select Committee on the European Communities. (A Community Framework for R&D, 17th Report of the Select Committee on the European Communities, 1989-90, HL Paper 66.) The framework sets broad policy objectives and total levels of expenditure. Once the framework has been adopted by the Council of Ministers, the Commission proposes specific programmes within the areas defined by the agreed framework. Each programme has its own budget and must be agreed by the Council. Once a programme has been proposed, the Commission will issue a "Call for Proposals", inviting applications for projects to receive support. Projects should be cross-border; have industrial relevance; and be pre-competitive. The Directorate General XII of the Commission, assisted by independent scientific and industrial advice, makes the final selection.

2.27 The Second Framework Programme was agreed in 1987 to run from 1987 to 1991 (5 years) with funding of 5.4 bn ecu (£3.6 bn). The Third Framework Programme was agreed in 1989 to run from 1990 to 1994 (5 years) with funding of 5.7 bn ecu (£4.2 bn). Funding of the Framework Programmes comes from the overall Community budget, to which the United Kingdom contributed about 20 per cent in 1990. The indicative United Kingdom contribution to the EC budget in respect of R&D was estimated at £171 million in 1989-90[1] and EC spending on R&D in the United Kingdom is likely to be of the same order. In view of the total United Kingdom expenditure on civil R&D (£2662 million in 1989-90) the contribution of the Framework Programme as an element of United Kingdom spending, at approximately 6 per cent of total civil R&D, is therefore modest.[2]. The funding comes from the Community's "own resources" and is distributed usually in the form of 50 per cent reimbursement of the costs of participants, companies or institutes. The basis of remuneration to the universities and polytechnics is considered further in Chapter 8.

2.28 The strategic "lines" for the third programme are:

information and communications technologies;

industrial and materials technologies;

environment;

life sciences and technologies;

energy; and

human capital and mobility.

The Commission originally said that line six, human capital and mobility, would cover the support both of postgraduate students and of basic research; in effect it would be an extension and

[1]The United Kingdom's contribution to the EC budget is towards the cost of total EC expenditure, not any particular element. This figure assumes that the United Kingdom's contribution to R&D is in the same proportion as the United Kingdom's contribution to the budget as a whole.
[2]In terms of total United Kingdom R&D expenditure (£4863 million) the Framework Programme amounted to just over 3 per cent of United Kingdom spending in 1989-90.

a broadening of the SCIENCE programme which is part of the Second Framework. But in the detailed proposals put forward by the Commission, virtually the whole funding for line six would be used for postgraduate bursaries. These proposals have not proved acceptable to member States, and there is currently deadlock on this issue between the Commission and the Council of Ministers. In particular, after the next few months there will be no further funds for the activities currently supported under the SCIENCE programme.

2.29 Specific programmes are usually known by acronyms and include (under the Second Framework) ESPRIT, RACE, BRITE, and EURAM (see Appendix 6). The United Kingdom's policy in the setting up of the Framework Programme is formulated by DTI with the assistance of the Cabinet Office S&T Secretariat. The responsibility for determining the content of specific programmes under the Framework falls to individual departments in accordance with their domestic policy responsibilities (DTI p 109–110; 1989–90 HL Paper 66, pp 6, 8–10). The research councils do not play a direct part. We explore this mechanism more fully in Chapter 6 below.

2.30 Thus the EC Framework Programme covers a wide range of types of R&D. But because it is restricted to projects that involve institutions in more than one Community country, and which have objectives that fall within the definitions of the lines agreed by the Council of Ministers, it is not a source of funds for individual, unstructured research.

Large Centralised Programmes and Facilities

2.31 Under this heading the Committee includes all institutions which are centralised and whose staff and users are multi-national. The principal collaborations of this kind in which the United Kingdom participates are the European Molecular Biology Laboratory (EMBL); the International Agency for Research on Cancer (IARC); the Ocean Drilling Programme (ODP); the European Organisation for Nuclear Research (CERN); the European Space Agency (ESA); the Institut Laue-Langevin (ILL); the European Incoherent Scatter Facility (EISF); the European Synchrotron Radiation Facility (ESRF); the Joint European Torus (JET); the Anglo-Australian, La Palma, and James Clerk Maxwell telescopes; the Along Track Scanning Radiometer (ATSR) and the Roentgen Satellite (ROSAT) (DES pp 125–129).

2.32 Some of the large facilities are managed by external parent organisations such as the SERC in the case of the ground-based telescopes, whilst others are managed by boards or councils that are specific to the facility. In the latter cases, the membership of the council is laid down in the founding statutes and includes all the principal funding partners. The council is entrusted with the supervision of the management of the facility in the broadest terms; the day-to-day management and the short-term development of the project is executed by the director and his staff. This model applies to CERN, EMBL, ILL, IARC, JET, and others. The budgets are determined in various ways. For CERN the treaty supposes that the overall budget will be agreed by the Council and the payments by the partners will be set in proportion to the GNP of the country concerned. At ILL the three partner countries on the Council agree a particular sum, equal for each, in the light of the technical proposals of the Directorate. At JET the budget is met from several sources: 80 per cent from the Commission, 10 per cent from the UKAEA and 10 per cent from the other partners divided in proportion to their domestic fusion programme.

2.33 In all these cases, the institution is a legal entity, able to buy and sell and enter into contracts, and can therefore act quickly and decisively on all day-to-day matters. Apart from JET, they employ staff on their own terms and conditions, and acquire all the legal responsibilities attaching to such employment. They are also the legal owners of their assets, though the statutes may make specific provision for their disposal both during the project and on termination. The statutes also normally cover responsibility for staff employed at the end of the project.

2.34 The situation is different at JET, which was set up to perform one single (albeit major) experiment. Its legal status is that of a 'Joint Undertaking' between the Commission and the other partners, namely the national Fusion Research Associations. JET is not an employer of staff; all the operatives are employees of the national Associations. The employees of the UKAEA are paid United Kingdom salaries (with certain minor enhancements), whilst those from other Associations are paid as Euratom Temporary Agents with expatriation allowances. Long-term career and retirement matters lie with the Associations. The physical assets may be assigned at termination to any Fusion Association, but the responsibility for any residue belongs to the

UKAEA as host. When the project finishes this may involve expensive disposal of large amounts of low-level radioactive waste, as well as taking over valuable buildings and other fixed assets. (By contrast, the Commission runs its Joint Research Centres at Ispra, Geel, Petten and Karlsruhe directly. All the staff there are permanent employees of the Commission, who determine the research programmes and own all the assets. Apart from the High Flux Reactor at Petten these laboratories do not contain large international research facilities of general importance.)

2.35 For many of the smaller facilities, the arrangements are quite different, with the local management being essentially agents of one or several parent organisations with only delegated powers. This is the situation at the La Palma and Anglo-Australian telescopes where the United Kingdom interest rests with SERC's United Kingdom observatories. It is also the situation for the optional 'menu' components of the ESA programme where the optional work is often carried out at locations belonging to one of the partners. In these cases the physical assets and staff responsibilities belong unambiguously to the parent organisations. The advantage of such arrangements is the avoidance of setting up major administrative services at the common centre; the disadvantage is reduced speed of action since consultations with the parent body are needed to make comparatively minor decisions.

2.36 Some collaborations involving large facilities will be *ad hoc* collaborations using another country's facilities. In atmospheric physics, for example, "a very modest financial contribution from the United Kingdom, relating to a key science or technology contribution by a participating United Kingdom group, has greatly augmented an ISP, hosted and mainly funded by other nations; in such cases, the United Kingdom contribution may be small but nevertheless buys a very substantial scientific participation, and allows the respective United Kingdom community to participate in a major new facility. Particular recent examples occur in the NASA Dynamics Explorer Program, the CRRES satellite, the UARS and Eos Programs" (Wilson p 190). Such participations are often initiated by the agencies (NASA or ESA) through a circulating "Dear Colleague" letter. Conversely, the United Kingdom (through SERC) is trying to interest other countries in contributing to the cost of ISIS, the spallation neutron source at Rutherford Appleton Laboratory.

2.37 The scientific imperatives which led to the initiation of a major collaborative project may be reassessed after some years; this may lead to reductions in budgets or termination. This inevitably causes administrative difficulties both between partners and between management and employees. It will be noted from the preceding paragraphs that the focus for such matters depends on the administrative structure of the institution as well as the budget liabilities and the way that they are expressed in the institution's statutes. It is necessary that consideration of new major projects should be searching and should carry long-term government backing. The possibility of launching new major facilities has therefore featured largely in our discussion of government machinery for determining participation in international scientific projects.

International Scientific Programmes in Context

2.38 The United Kingdom's contribution to civil international scientific programmes amounted to approximately £342.4 million in 1989 90. This was about 7 per cent of total Government expenditure on R&D. Table 1 provides a detailed breakdown of United Kingdom participation in the principal ISPs and shows that United Kingdom expenditure was split between the EC Framework Programme (£171 million) and other multilateral and bilateral collaborations (£171 million).

2.39 There is, however, a lack of clarity about the United Kingdom figures for expenditure on ISPs. For example, Table 6.3 of the 1990 Annual Review of Government Funded R&D indicates that the United Kingdom spent £585.2 million in contributions to multilateral and bilateral projects (civil and defence) in 1988. The defence component of £305 million agrees with the figure provided by the MOD in Table 2c of the Annual Review. However it is not possible to identify the destination of all of the remaining civil expenditure (£280 million) from the data provided within the Annual Review. Moreover some of the data provided by the DES, in evidence to the Committee, differs from that provided by some Research Councils in the Annual Review.

TABLE 1

United Kingdom participation in International Scientific Programmes

Programme (1989-90)	*£ million*
1. EC Framework Programme	171.0
2. Other Multilateral and Bilateral Collaborations	171.4
Cabinet Office:	
European Co-operation in Scientific & Technical Research (COST)	1.0
DES:	
European University Institute (EUI)	0.1
Centre for Education Research and Innovation (CERI)	0.1
DTI:	
European Space Agency (ESA)	51.8
HSC:	
Release of toxic and flammable substances, etc . . .	1.5
ODA:	
Consultative Group for International Agricultural Research (CGIAR)	6.5
WHO Programmes	6.5
MRC:	
European Molecular Biology Conference (EMBC)	0.6
European Molecular Biology Laboratory (EMBL)	2.6
International Agency for Research on Cancer (IARC)	0.5
Tropical Medicine Research Board Laboratories (TMRBL)	2.7
NERC:	
Joint Global Ocean Flux Study (JGOFS)	2.7
North Sea Programme	1.3
Ocean Drilling Programme (ODP)	1.4
Satellite Remote Sensing	0.1
World Ocean Circulation Experiment (WOCE)	0.0
SERC:	
Along Track Scanning Radiometer (ATSR)	0.1
Anglo-Australian Observatory (AAO)	1.3
European Incoherent Scatter Facility (EISF)	0.4
European Organisation for Nuclear Research (CERN)	48.9
European Science Foundation (ESF)	0.2
European Space Agency (ESA)	25.7
European Synchrotron Radiation Facility (ESRF)	3.8
Infrared Space Observatory (ISO)	0.7
Institute Laue Langevin (ILL)	8.7
James Clerk Maxwell Telescope (JCMT)	1.0
La Palma Observatories	1.0
Roentgen Satellite (ROSAT)	0.2
Total Expenditure	342.4

Derived from: Annual Review of Government funded R&D and DES Written Evidence (pp. 125-129)

2.40 The Committee consider that the Cabinet Office should, in formulating the 1991 edition of the Annual Review of Government Funded R&D, ensure that the Research Councils and the Government departments clearly identify the amount of expenditure they contribute to ISPs, and include a separate section, which draws together United Kingdom participation in ISPs.

CHAPTER 3: ADVANTAGES AND DISADVANTAGES OF INTERNATIONAL SCIENTIFIC PROGRAMMES

3.1 Different kinds of international collaboration are entered into for different reasons and, as we have seen, with different structures. Most of our witnesses alluded to the advantages and disadvantages which they had experienced, and they revealed as much variety as do the programmes themselves. Nevertheless a general synthesis is possible.

3.2 As we have already said, few scientific programmes of work even when conducted on an entirely personal level can flourish without effective contact with colleagues doing similar work —many of whom are bound to be overseas. The advantages of these contacts, even at the simplest level, include mutual stimulation in the subject; a pooling of human resources; the development of networks; the use of a high degree of specialisation within a broad framework; and a more efficient use of scientific effort through the avoidance of unnecessary duplication of work (though some duplication is always necessary for the purpose of validating results and to ensure a climate of competition). The cultural benefits of improved international understanding and enhancement of the standing of United Kingdom scientists overseas cannot be ignored (pp 35, 39; Fellowship

of Engineering pp 321–4; Thompson p 363). Personal contacts of the kind described in paras 2.3–13, by virtue of their very informality, incur none of the disadvantages, except the cost in time and money of travel, which more elaborate arrangements can bring about.

3.3 More elaborate multi-centred collaborative projects carry with them all the advantages of purely personal contact but their greater degree of formality and the existence of some kind of budget or common resources may increase the returns that can be obtained. Through specialisation, the quality of results is improved—a higher "value added" is obtained for the outlay. Access is gained to a wider field of activity and results than would be possible with a similar outlay at home. Major scientific issues confronting the world—like climate change, or health —can be addressed more effectively, from both a scientific and a political point of view. Work on major challenges to scientific knowledge like the documentation of the Arabidopsis genome can be channelled and expedited. And for even the strongest scientific culture there will be some inward flows of knowledge in areas of national weakness (pp 55–57; 73; 88; Fellowship of Engineering pp 321–4; Q 763).

3.4 EC programmes have the additional political benefit that they will tend to improve European "cohesion"; and they will seek to develop those areas of science which are best done at a Community rather than a local, national or bilateral level. It is a basic tenet of the EC that their programmes should be subsidiary to (ie decided in the light of) national programmes.

3.5. But the more elaborate nature of the formal multi-centred collaborative projects bring certain disadvantages too—chiefly bureaucratic inefficiencies in setting them up, and losses of time through travelling and other causes in their execution. The incidence of this kind of problem will be greater the more elaborate the programme. Programmes which are essentially co-ordinations of nearly independent work are likely to be less affected. Additional time and money is required to manage the programmes, whether this is done by the participants themselves or by the establishment of a small programme office. (The United Kingdom, for example, hosts the WOCE programme office.) Scientific objectives may need to be modified. Participants may have different abilities and aims; less rigorous criteria may be applied to projects than under national programmes either because of the need to agree objectives with other collaborating parties or because objectives are simply not consistent with those which would have been applied domestically; and insufficient regard may be paid to monitoring the efficacy of the programme (pp 57; 73; Fellowship of Engineering pp 321–4; AFRC pp 272–5).

3.6 Some of these disadvantages impinge most heavily on the most formally organised programme of all—the EC Framework Programme. A number of witnesses thought that the political requirement for collaboration led to inefficiencies which purely national effort would have avoided; and there was frequent mention of poor and anonymous evaluation.

3.7 The international programmes which are centred in a large facility, like CERN, ILL, ERSF or ESA, have the principal advantage of enabling participants to engage in research which would otherwise be beyond their means. Were the work not carried out in conjunction with others it simply would not get done, principally because the equipment costs are prohibitive, but also because the subject needs a "critical mass" of interest and expertise for it to be done properly which cannot be supplied at national level. Other large facilities—like astronomical observatories —or common use of research vessel time bring the advantage of sharing a particular location of scientific importance. And all joint facilities provide a healthy atmosphere of intellectual stimulus, motivation and development of technique (pp 56, 73, 88; Miller pp 348–9; AFRC pp 272–5).

3.8 On the other hand, of all collaborative projects, large international facilities can have the most acute disadvantages. Their high cost brings considerable inflexibility into domestic science budgets, especially that of SERC. Unexpected movements in costs place great strain on the resources available for "small" science. And the inflexibility of their consensus-based decision-making processes makes it difficult to adjust the goals of research to changing circumstances. Equally, when goals do change, it may not always be in line with national priorities or preferences. Large facilities are also difficult to scale down or close (pp 57, 76; QQ 289 and 327; Miller pp 348–9).

3.9 The evidence which we received indicated that the scientific community—researchers, universities, research councils, government and industry—were fully aware of the criteria which had to be borne in mind in assessing the balance of advantage in engaging in international collaboration. Indeed, so far as departments and research councils were concerned, the Cabinet

Office "Guidelines for Future International Collaboration" (pp 45–6) offer advice aimed at protecting United Kingdom collaborating bodies from the worst effects of ill-formulated schemes. We consider the efficacy of these guidelines in a wider context in Chapter 7. All the evidence we received suggested that the balance of advantage was always in favour of appropriately scaled international scientific programmes.

Committee Opinion

3.10 The Committee has not been concerned with the management of specific international programmes. But it is clear to us that well-managed collaboration is an essential feature of scientific progress. It is necessary, therefore, to examine whether or not the United Kingdom's machinery for responding to such programmes is all that it should be.

PART 2: SETTING UP INTERNATIONAL SCIENTIFIC PROGRAMMES—THE PROBLEMS OF MACHINERY AND RESPONSE

CHAPTER 4: INFORMAL AND PERSONAL PROGRAMMES

4.1 Given the wide variety of international scientific programmes described in Chapter 2, the method of setting them up and the problems that are encountered in so doing are bound to vary widely too. The Committee considers first the informal and personal programmes. Many witnesses spoke of the importance of direct personal international collaboration. Indeed, Sir David Weatherall told us that "Scientific collaborations are very personal affairs" (p 366).

4.2 On the whole, however, the means of initiating personal collaborations are straightforward and will arise from a common interest that has already been identified through literature, from conferences or from contacts established through ICSU, the British Council, the Royal Society, ESF or NATO. These "uni-directional" collaborations are initiated by the individuals concerned rather than through any control mechanism (United M&D Schools, p 287). It did not appear therefore that personal collaborations suffer from want of machinery to set them up. To the extent that organisations like British Council and ICSU are involved in promoting and occasionally funding collaborations or exchanges, no problems were reported. For example, the Committee heard evidence from the British Council that decisions on exchanges supported by them were taken locally by their officers with central office help where necessary. In the case of the more elaborate country collaborations (Acciones Integradas, ARC and Alliance) the research council mechanism is used for assessing proposals before they go to a final board drawn from both participating countries (Q 128).

4.3 Incidental problems can arise with incoming overseas scientists. Language is little barrier within Western Europe, North America or the Commonwealth. But for the Far East, and even for the Soviet Union, there are difficulties of language and culture. Where these difficulties arise, they are sometimes complicated by restrictions on the exchange of currency, which can make payment of subsistence to the host country (eg the United Kingdom for a visiting Chinese) very difficult. Both cultural and currency matters can be considerably eased if there is a cultural treaty or memorandum of understanding between the countries, but we were told that the importance of such general international agreements was limited (Q 76).

4.4 Intellectual property rights were not considered by witnesses to be an inhibiting factor in respect of these informal collaborations since, if they arose at all, they were such an integral part of the collaboration that they were fully taken into account at the start (UMIST pp 330–122).

4.5 For British scientists undertaking personal collaborative projects overseas, when funds are not forthcoming from other sources or from the organisations described above like NATO or the British Council, application is made to the relevant research council. For small projects a prompt response is usually possible. As SERC informed the Committee, "At the lowest level, the decision to participate may be considered and reached wholly in the appropriate grant-giving body (Subject Committee) of the SERC which has delegated powers up to a certain level. This would apply to the scientific programmes of ESF (funded on an *a la carte* basis) ..." (p 74).

4.6 The Committee received evidence that SERC gave grants for travel grants (Q 312). There were complaints however that grant-making bodies made insufficient provision for travel (Lord

p 346). There were also pleas from academic researchers that British Council bilateral schemes (with Spain, France and Germany), which they commended highly, should be extended from subsistence and travel costs to cover short-term salaries and minor equipment costs (Shore pp 359–60; McCleverty Q 889).

4.7 We also received evidence that the recent readjustment in the boundary of "dual support" responsibilities might inhibit personal collaborative ventures. "Dual support" is the system whereby university research is financed partly by research council and other grants and partly by an input from university general funds sufficient to maintain a basic "floor" of research capability, "enabling speculative ideas to be generated and developed to the stage at which specific funding can be sought" (*Civil Research and Development*, 1st Report of the Select Committee on Science and Technology 1986–87, HL 20-I, p 19). In a move to make Research Councils wholly responsible for the costs of projects they sponsor, £150m (£50m in 1992–93 and £100m in 1993–4) will be transferred from the Universities Funding Council grant to the Research Councils. We heard that university departments were already hard pressed to sustain research themselves (Q 883). The loss of local control of this money will curtail the freedom of universities to initiate research programmes and to support them with suitable travel grants.

Committee Opinion

4.8 The Committee considers that personal and informal collaborations are very important. We do not think that any major issues of machinery of government or of other institutions arise in these cases. But international collaboration will continue to grow in importance as the United Kingdom percentage of total world science continues to fall, and it follows that international travel will become steadily more important for United Kingdom scientists. Our concern about the scarcity of travel money is heightened by the proposed transfer of money away from the UFC to the research councils. We have considered whether there should be guidelines from the research councils or the UFC on the availability of travel funds for active researchers. There will always be competition within research council programme and project budgets between expenditure on travel and on equipment and no formula seemed to us to meet this difficulty.

4.9 We therefore recommend that specific efforts are made to ensure that the proposed transfer of money to the research councils from the UFC does not result in a diminution of funds for travel, especially in the formative stages of international collaborative work. To this end, the research councils and the universities (through CVCP) should meet, perhaps under the aegis of the Royal Society, to review the provision of travel funds for young researchers.

CHAPTER 5: FORMALLY CO-ORDINATED MULTI-CENTRED PROGRAMMES (WITHOUT FUNDING)

5.1 It is useful to distinguish between those programmes which do not have funding of their own (paras 2.17–2.23 above) and those which do (paras 2.24–2.30 above). Of those which do not have funding of their own, direct collaborations involving government departments or research councils appear to offer the least difficulty.

5.2 International collaborative projects in energy through IEA appear to give rise to no problems of response at all. The Committee received evidence that IEA had established rules for setting up new "implementing agreements" and all programmes shared a common legal and administrative framework. Any new agreement or new work under an existing agreement was assessed by the Department of Energy, taking advice as necessary, and the final decision to participate was taken by their R&D programmes manager. Programmes often involved participation from non-government sources. Similar procedures apply to NEA and IAEA work.

5.3 The advantage of this system, so far as the Department of Energy is concerned, is that it is entirely voluntary (p 165; Q 485). Any research groups from two or more OECD countries may initiate costed proposals for a research programme. The OECD then sets up a monitoring group to ensure distribution of the results to those entitled to receive them and entrusts the management of the project to one of the participants who becomes the "operating agent". It was made clear to us that the IEA NEA procedures were well understood by the Department of Energy and the industry and that the Department thought very highly of the IEA mode of initiating ISPs (ibid).

5.4 The Ministry of Defence's bilateral and multi-lateral collaborations under the umbrellas of NATO, the Independent European Programme Group (IEPG) (NATO without Iceland) and the Technical Co-operation Programme (ITCP) (USA, Canada, United Kingdom, Australia and New Zealand) also appeared to give rise to no administrative difficulty (MOD pp 350–1). Nor did we hear of any difficulties arising out of international programmes involving government departments which had been co-ordinated through COST.

5.5 Setting up bilateral collaborative projects by research councils or government departments also appeared to be relatively painless. Such collaborations are normally conducted under Memoranda of Understanding, based on a comparison of the two countries' priority areas. Decisions on the bilateral programmes of AFRC with overseas research organisations are taken by the Council on the advice of its Regional Committees and Management Board having regard to its strategic policy objectives (AFRC p 279, para 17). Such collaborative projects have to compete with other claims and must show that international collaboration is to be preferred to purely domestic programmes. But as bilateral collaborative projects under MOUs are engendered from within the participating agencies there appear to us to be no issues of machinery or response which require attention.

5.6 We turn now to international multi-lateral scientific programmes which emerge following proposals from individual scientists or research teams through NGOs like ESF and ICSU or IGOs like the UN agencies (see paras 2.17–2.19 above). The way in which these programmes are formulated and the procedures whereby United Kingdom scientists identify areas they consider of value was described to us in detail by NERC, in respect of the International Geosphere Biosphere Programme proposed by ICSU and the World Ocean Circulation Experiment proposed by ICSU and WMO (QQ 346–349). But—so far as concerns United Kingdom participation—such projects almost invariably have to seek research council funding. As NERC told us, "... it is the funding agencies which have to decide on the resources which can be made available. In particular, the final decision to participate in an ISP can only be confirmed if resources have been won through the competitive Research Council machinery" (p 90). Witnesses complained to us in respect of the working of this machinery.

5.7 In respect of personal and informal collaborations, many which emerge from umbrella organisations and which give rise to costs above the purely personal, eg for equipment, can be considered and decided upon within the appropriate Subject Committee of the relevant research council, or by the Council itself (pp 74, 91). But as Sir Mark Richmond, Chairman of SERC, told us, "... if you are a young research worker wanting to start international collaboration ... you try and start it on a one-to-one basis and you try to do it within an area where one committee in the Research Council can make the decision. That is not always possible" (Q 309). Indeed, the Committee heard complaints that consideration by these committees sometimes took a very long time and that the system was unresponsive.

5.8 The timetable might be extended where a research council finds that "the most appropriate level in terms of the scientific contribution which we could make may be in excess of the resources available and additional funding may need to be sought through bids to the Advisory Board for Research Councils (ABRC)" (p 91). The annual cycle of the PES round then adds further to the decision-making process: the research council puts in its bid to ABRC which advises the Secretary of State for Education and Science who in turn has to secure the agreement of the Treasury—a process in itself taking many months or even more than a year if the timing falls badly in respect to the PES round. Thus research council discussion of a major contribution to an international programme like WOCE takes almost as long as those involving large facilities which we describe in Chapter 7.

5.9 NERC, which is currently prominently involved in supporting the various ICSU/WMO projects on climate change, is well aware that "there is often a time-limited 'window of opportunity' for participation" (p 89) and that there are problems in synchronising the United Kingdom decision making process with that "window" (Q 352).

5.10 But the difficulties are not all the fault of the research councils. It was represented to us that the situation might be improved if researchers gave research councils early notice of planned international programmes. As NERC said, "Consultation with funding agencies at an early stage in planning can assist both funding agencies and the planning group" (p 91). And SERC, speaking in the slightly different context of seeking agreement on a new telescope, talked of problems of "communication between individuals who have had a personal and direct involvement in some of these discussions, and others who are having to rely on those individuals or other methods of communication to be kept in touch with what is going on" (Q 297).

5.11 Finally, we include in this section the projects promoted under the EUREKA programme. The Committee received evidence that the EUREKA programmes were deliberately bottom-up industrial collaborations: "The programmes under EUREKA come from suggestions from industry, there is nobody at the top saying: 'We should go into this area or that area', it comes from the bottom and that was a deliberate style which was introduced at the beginning" (Q 392). The central secretariat in Brussels is small and principally concerned with disseminating proposals for programmes throughout the member countries, "... a relatively light touch as compared with the Framework Programme" (ibid).

5.12 The role of the United Kingdom's DTI is to publicise EUREKA and its programmes. The Committee received evidence of its work in this area and copies of its promotional material. DTI also transmits proposals from United Kingdom industry to the central secretariat, but interested companies may approach one another directly (Q 393).

5.13 As we have shown in para 2.22 above, national governments may offer financial support to their own participants in EUREKA schemes. In 1989–90 DTI is estimated to have spent £5.6m in this way, rising to £11.0m in 1991–92. For the future, the Committee was told that DTI was seeking to establish "clearer ground rules for domestic support in order to encourage United Kingdom industry to participate in EUREKA projects ..." (p 110).

5.14 The Committee received evidence from British Aerospace of some seven projects which had been accorded the EUREKA label and which involved Aeritalia, Aerospatiale, CASA and MBB as well as BAe. British Aerospace spoke highly of the EUREKA mode of promoting research (pp 242–3), though the European aerospace industry finds that EUREKA's lack of a common budget makes funding difficult if one partner fails to get support from its government. The insistence on product-oriented research prevented more "basic" technology research from taking place under EUREKA (p 243). Mr Brian Oakley complained of the lack of coherence of EUREKA programmes compared with Commission programmes (Q 724). And the Fellowship of Engineering thought the bureaucracy "excessive" (pp 321–4).

5.15 On the whole, however, the EUREKA programme received widespread praise, as did the DTI for promoting it. Such complaints as we received seemed to us to be inevitable given the character of the programme. There appeared to be no systematic problems with the machinery for proposal and response.

Committee Opinion

5.16 Of the formally co-ordinated multi-centred programmes without funding of their own, those collaborations which are initiated by government departments and research councils themselves give rise to no problems of machinery for proposals or response which require our attention. The reason for this seems to be that while the programmes have no money of their own they have guaranteed access to the budgets of the participating departments or research councils.

5.17 The EUREKA programme appears to work well in the United Kingdom, and DTI's role in promoting it is to be commended.

5.18 Where programmes are promoted by ICSU, the UN, ESF or by any other IGO or NGO which requires funding through application to the research councils then problems do arise. While the United Kingdom arrangements are not significantly worse than those elsewhere, the speed of research council response seems slower. We deprecate unnecessary delays.

5.19 However, the Committee agrees with research councils that such proposals must be considered on their merits in competition with other applications for financial support in the usual way.

5.20 At the same time, the Committee considers that researchers may have unrealistically high expectations of the ability of research councils to respond quickly. We urge potential collaborators to give early notice to and seek early advice from research councils concerning both programmes and the formulation of the competitive case for the use of United Kingdom research money in respect of which applications are to be made.

CHAPTER 6: FORMALLY CO-ORDINATED MULTI-CENTRED PROGRAMMES (WITH FUNDING)

6.1 The mechanics of applying for research funds from the major world agencies' own science budgets (UN, WHO) are well known to the individuals and organisations most concerned. Proposals are submitted following specific calls. Decisions are quickly arrived at and contracts awarded accordingly. Since there are not usually many restrictions on co-operative partnerships, applicants feel in control of the submission.

6.2 While United Kingdom scientists benefit from its largesse, there were nevertheless a number of complaints about the Human Science Frontiers Programme, principally stemming from the manner in which it was set up. SERC complained that although it had been proposed by the Japanese prime minister at a summit meeting and set up with a considerable initial Japanese budget for international spending, the Japanese had few practical ideas about content and management. The United Kingdom became involved in negotiating a workable scheme of allocation of grants but later financial contributions to it by the United Kingdom research councils (SERC and MRC) are still under discussion. SERC's view is that they are "effectively being asked to contribute from their own research budgets to an international programme which is not of their making nor directly accountable to them" (pp 73–74). MRC views it as a "Trojan horse" (Q 677). The research councils clearly felt compromised by the United Kingdom's adherence to this initially ill-defined "top-down" scheme.

6.3 The principal interest for the Committee in this chapter however lies with the EC Framework Programme.

6.4 The Framework Programme of the EC gave rise to lively comment from almost all the principal groups of witnesses who gave evidence to us. The machinery for setting up collaborations under the Framework Programme was on the whole clear to universities, research councils and individual scientists alike. Applications for funds under the Framework Programme are made by researchers from academic institutions and from industry in respect of calls for proposals from the Commission for work in well-defined areas. Proposals can only be submitted by groups of collaborators in several different countries. Thus when a researcher has identified a line of work that falls within the defined areas eligible for support, he also needs to find a group of co-workers in other countries with whom he can work out a fully costed proposal. This is then considered in competition with other proposals by the Commission, advised by a system of peer review.

6.5 We were told in evidence by BP, "The decisions about funding proposals are taken in three stages by committees within the EC. In the first stage, the technical worth of the proposal is assessed by experts in the field from various member states. The list of selected projects is then passed to the programme committee with representatives from each of the member states of the EC. The final decision is made by the appropriate Directorate-General of the Commission. The proposals are considered within rigid cash constraints, and in many cases the maximum funds per application are specified when the call for proposals is published. In some programmes, small and medium-sized companies are more welcome applicants than multinational corporations. The only technical consideration of proposals is during the first committee stage when the applications are reviewed without the nationality of the proposer being known. It seems that delays in the progress of applications occur when national interests come into play in the later committee stages" (BP pp 285–6). There is normally a high degree of competition for funds, and more proposals are received than can be fully funded. The awards may then be scaled down, so that although the research is to go forward, it is left to the participants to find the necessary economies without harming the final outcome of the work.

6.6 The Committee were favourably impressed by the high level of awareness in the universities, research councils and amongst individual scientists of the importance of the Framework Programme as a source of research funding and by their ability to gain funding from it. The machinery for applying for support—which is administered by DGXII of the EC Commission—is well understood. The research councils have set up a liaison office in Brussels (IPMS pp 338–9) and some universities have offices—like Bristol University's Industrial Liaison Office and their European Liaison Officer—which actively publicise opportunities for collaboration in Framework projects (pp 278–9).

6.7 Though aspects of the procedures were criticised, the mechanics of the Framework Programme itself were not assailed in evidence. On the contrary, some witnesses thought EC procedures no worse than those of the United Kingdom. We were told by British Aerospace, "... though it is a complex system, working the system, once one gradually progresses through the machinery ... in fact is no more difficult than working the system in a national community" (Q 836). And there was praise for the DTI and other departments for the assistance they gave in promoting applications for funds. We were told by BP that "There is a contact for each EC-sponsored R&D programme within the appropriate Ministry or Government agency, who gives assistance with the preparation and submission of grant applications. These contacts are also able to give detailed advice on suitable topics for R&D proposals within each programme, and to advise on the likelihood of success of a particular application. The impression is that the Government is keen to ensure that Britain obtains its share of EC R&D funds" (BP 285–6). Such criticisms as emerged in evidence were largely incidental to the machinery of the Framework Programme.

6.8 *Negotiating the Programme*: The formulation of the recent new Third Programme and its constituent programmes followed wide consultations through expert committees. These were set out in Commission evidence (pp 368–72) and were also conveniently summarised by Sub-Committee B of the Select Committee on the European Communities (1989–90 HL Paper 66 p 8) as follows:

> "... In particular, three committees aim to ensure that industry, the scientific community and public authorities all have an influence. The first is the Scientific and Technical Research Committee (CREST), on which two representatives of each national government serve. CREST co-ordinates research policies between Member States and the Community. It is chaired by a senior Commission official.The second Committee is called CODEST (Committee for the European Development of Science and Technology). This prepares strategies and proposals for new areas for support, especially in basic research and in fields important to universities and scientific organisations. Its members are figures well-known in science, technology and industry.
>
> The third Committee is IRDAC (Industrial Research and Development Advisory Committee), which advises on industrial research and development. Fourteen members with experience in these areas are appointed on an individual basis by the Commission and four others represent UNICE (the Community equivalent of the CBI), the European TUC (ETUC), the European Centre of Public Enterprises (EEP) and the European Association of Industrial Research Institutes (FEICRO).
>
> The Commission also takes advice from a Specialist Committee on nuclear matters; and from special support committees for specific programmes, on which two representatives of each Member State serve".

6.9 We were told in evidence by Sir John Fairclough that the Cabinet Office S&T Secretariat and the Chief Scientific Adviser played a leading role in negotiating the content of the Third Framework, and ensuring that Government Departments focused their attention on the proposals (QQ 145–146). The Chief Scientific Adviser and his colleagues also provided the United Kingdom's two members of CREST (Q 145; p 109). The lead Government department in Framework Programme negotiations is the DTI because over 50 per cent of the funding falls in areas of DTI responsibility. Thus the Secretary of State for Trade and Industry has overall ministerial responsibility. DTI told us how they were assisted by the S&T Secretariat in co-ordinating their response with other departments and how DTI itself consulted with industry, DTI's own advisory committees and informally with companies, individuals or ACOST (p 109; DES p 120). Government witnesses thought that recent consultations and negotiations on the Third Framework Programme had worked well. In the words of Sir John Fairclough, the outcome of the final meeting on the financing of the programme had been "... wholly satisfactory" (Q 145).

6.10 But the Committee heard from other witnesses—individual scientists and the research councils—that they felt remote from this decision-making process. SERC told us that "Although the Research Councils in recent years have been more active in influencing the control of EC R&D programmes, such programmes are ultimately decided at political level—in the EC Research Council of Ministers—in which political considerations inevitably play a role" (p 74). Moreover the Research Councils have no "direct involvement" in this process (p 75 and Q 282). Research Councils could approach the Commission direct, but had no role in the formal decision-making

process, nor was it practicable to make use of their own peer review system in formulating responses to EC proposals (Q 278). MRC told us that research councils lacked influence "because the mechanisms we have in place within this country do not allow us to make the quality of input that I think would be helpful and because within Brussels, where the programmes are originating, we do not succeed" (Q 667). MRC considered that they were not well represented by DTI's leading role in Framework decisions and that the co-ordinating role of the S&T secretariat fell short of what was required (QQ 672–5).

6.11 Sir David Phillips of ABRC explained to us that he and heads of research councils were consulted by the Cabinet Office in respect of the Framework Programme but that they were not asked for collective advice, though they would be prepared to give it (Q 610–613). However, members of ABRC and the research councils had long been involved in the advisory work of CODEST (QQ 614–6). Although not "desperately dissatisfied" with the machinery for setting up the Framework Programme, ABRC did feel that "formal scientific contributions to the debate about European programmes and, in particular, priorities between programmes in Europe are not as strong as they should be" (Q 619). Other criticisms relate in the main to the operation of specific projects under the Framework once it has been established.

6.12 *Levels of funding*: Some witnesses complained that the financial benefits of participation in Framework Programmes sometimes fell short of expectation. They said it was difficult, especially in universities, to find the money and time to have the necessary detailed discussions with overseas partners to produce a properly constructed and fully costed research plan. If the proposal was rejected this was money wasted; if it was accepted, the money so spent was not admitted as an expense of the work for later reimbursement (BP pp 285–6; Kingman pp 342–4). However there was also evidence of some assistance from other sources to meet travel costs at least. DTI were now assisting applicants for EC funds with small "pump-priming" travel grants (Oxford pp 279–80); and SERC were also giving travel money for the same purpose (Durham pp 300–1).

6.13 Another difficulty is that when the contract is received it is often arranged to start at a different time from what was assumed in the submission, and the allocated funds may have been scaled down. This is because there is normally a high degree of competition for funds and more proposals are accepted than can be fully funded. Awards may therefore be scaled down, because of the Commission practice of dividing the cake of cash limited programmes for political reasons (Bristol pp 278–9, BP pp 285–6). And EC grants do not allow for United Kingdom inflation —though denominating them in ecu helps to protect recipients against exchange rate fluctuations (Kingman pp 342–4).

6.14 *Quality of proposals*: Some witnesses expressed the view that the Framework Programme represented an easy way to obtain support for work which failed to receive it from the research councils. The Chairman of SERC thought these allegations "... sufficiently widespread that one has to take them seriously" (Q 337). The pro-active role played by EC programme managers, who sometimes disregarded the advice of their assessors, was held to be partly responsible for this (QQ 337–8). The Chairman of ABRC on the other hand thought that "the stringency of judgment on the Framework Science Programme projects ... was at least as severe as judgments by the research councils on United Kingdom projects" (Q 655).

6.15 *Evaluation*: The Cabinet Office seemed content with the overall evaluation procedures for the Framework Programme—both at Commission and at national level—and thought that the rolling nature of the Framework Programme enabled ministers to adjust the balance of programmes if necessary (QQ 190–91). As Professor Fasella told us, the three-year evaluation can modify work done in the fourth and fifth years of the Programme but has even more effect upon the shape of the subsequent Programme (QQ 851–3).

6.16 But some witnesses complained that evaluation of specific projects under the Programme and its constituent parts was inadequate and sometimes inappropriate. Currently, the EC Commission set "milestones" for projects, and half-way through a programme's life an evaluation was conducted by Commission officials assisted by independent panels. The Commission appears to have made considerable strides in introducing evaluation of its projects and in assembling its independent panels (QQ 863–5). But witnesses thought that the evaluation conducted by the Commission was inadequate. Evaluators were arbitrarily selected by the Commission and were by and large unknown to scientists involved (QQ 891–3; 898). And there appeared to be considerable differences between EC "milestone" evaluations and the research management familiar to United

Kingdom scientists. Indeed, one piece of evidence we received urged the Commission (in the field of medical and health research) to move towards "the provision of rigorous peer review by international panels of scientists of all applications for funding and evaluation of projects terminating and or seeking renewal". Better programme management at the Commission was also called for (Maynard pp 346–7).

6.17 *Overheads*: The Committee received extensive evidence on the problems for university departments (but not for industry) of EC practice on overheads costs, in consequence of which universities considered themselves to be "subsidising" EC projects (Bristol pp 342–4, 278–9). We consider this issue in Chapter 8.

6.18 *Additionality and attribution*: We also received forceful evidence from a number of sources on United Kingdom Treasury practice of "attributing" sums received from the EC in support of UK-based research to the annual budgets of Departments and Research Councils and adjusting those budgets in a way which meant that receipts were only partly "additional". This issue is also explored more fully in Chapter 8.

Committee Opinion

6.19 The Committee considers that United Kingdom response to and participation in UN and WHO research contracts gives no cause for concern.

6.20 We think that the gestation of the Human Frontiers Science Programme would have been easier had the Cabinet Office already taken a greater strategic interest in collaboration with Japan. Had the bilateral round tables commenced their work (see para 2.23 above) it is unlikely that the project would have been proposed without some prior scientific input from likely participants. We have noted in a different context how the Cabinet Office secretariat is now taking a strategic interest in co-operation with Japan, France and Germany. The experience of HFSP leads us to recommend that the Cabinet Office strengthen its strategic capability in respect of possible future international programmes, especially with Japan.

6.21 The Committee note with satisfaction the wide United Kingdom take-up of EC funds under the Framework Programme and consider that the machinery for applying for funds is well understood. Aspects of the Framework Programme give cause for concern, however. United Kingdom research councils and scientists feel remote and marginalised in the discussions leading to the establishment of the programme. So far as concerns research councils this appears to us to be due to the lack of direct formal and acknowledged consultations between the Cabinet Office S&T secretariat and ABRC or the research councils on the content of the programme. There is too much reliance on informal contact both within Whitehall and Brussels and through the *ex officio* seat of the Chief Scientific Adviser of the ABRC. This feeling of exclusion and inadequate representation is much to be regretted, given the increasing effects of attribution and additionality on Research Council budgets (see Chapter 8 below).

6.22 The Committee heard from Sir David Phillips that he would be "quite content" to be asked for collective advice on the European Framework Programme (Q 613). We think that while for political reasons, such consultations may not necessarily affect the eventual outcome at the Council of Ministers meetings at Brussels, they would at least reassure the research councils that they had a direct input into the advice tendered to ministers. Given the co-ordinating role of the S&T secretariat in formulating advice to ministers on the Framework Programme, the question whether DTI or DES ministers should represent the United Kingdom at those meetings would then be of less significance than it appears to be at present.

6.23 The Committee therefore recommend that, for the future, ABRC be formally asked for a collective view on the content of the Framework Programme, including an interim view on the second phase of the Third Framework Programme. All research councils should be given an opportunity to participate in direct briefing of the Cabinet Office if they so wish.

6.24 The scientific community is large and not completely represented by research councils. We therefore urge individual scientists to take full advantage of the Commission's own consultative procedures (see para 6.8 on CODEST and IRDAC). We consider also that it behoves the Cabinet Office to obtain views from the wider scientific community, possibly using the Royal Society and Fellowship of Engineering as the instruments of such consultation.

6.25 We consider that evidence concerning the quality of proposals which are accepted for support under the Framework Programme is ambiguous. Many researchers would as a matter of course have looked for support from national, chiefly research council, sources before modifying their proposal to give it a multi-national basis and turning to the Framework Programme. This means that proposals accepted under the latter may, albeit possibly in a modified form, have been rejected by the former. This is by no means undesirable. We think that there are definite advantages in preserving pluralism in the funding of research, with alternative sources refereed by different people. Criticism may also be partly due to the fact that the Framework Programme pursues different scientific goals. However, political considerations could reduce the quality of EC programmes and it is imperative that the United Kingdom government representatives are briefed to guard against this.

6.26 The Committee attach great importance to the evaluation of the Framework Programme and its constituent programmes and to the individual projects under those programmes. The point of evaluation—whether undertaken during or immediately after a project—is to determine whether or not the scientific content is good and how nearly objectives have been attained.

6.27 We recognise that the Commission has recently given more attention to evaluation than in the past. We believe that there is scope for this evaluation to be put on a still more systematic basis, with the involvement of an even wider community of expert evaluators. We therefore recommend that financial provision be made under each programme for periodic evaluation of projects; that the names of the evaluators and their findings be made public; and that the Commission be continuously alert to the need to maintain and enhance the calibre of its evaluators.

CHAPTER 7: LARGE CENTRALISED PROGRAMMES AND FACILITIES

7.1 The means of initiating proposals to establish a large centralised programme vary. Some will emanate from the research community itself. EMBL, for example, developed out of a meeting of molecular biologists in Ravello, Italy in 1963 under the inspiration of Sir John Kendrew (p 341); ESRF was set up following discussions through ESF; the European Trans-Sonic Wind Tunnel is being constructed following a coming together of the national aeronautical research establishments of the United Kingdom, France, Germany and the Netherlands; JET was set up as an autonomous Joint Undertaking between the Commission and the ten Fusion Associations of the national laboratories co-operating with the Commission. Sometimes approaches come from foreign governments at ministerial level—like the recent attempt by the USA to gain support for their super-conducting super collider (p 75).

7.2 Most collaborations involving large centralised facilities possess certain common features: the usual way for a proposal for a large-scale project to arise is when a number of scientists in a certain area of study realise that the cost-effective way for progress in their field is the construction of a new machine, or the assembly of a large group of workers and supporting facilities like computers or communication networks at some single centre. The potential users then formulate in each country a proposal to national research funding bodies, while collaborating on the design and costing of a practicable technical solution. These are both lengthy tasks, and the timing in each country as well as between countries is difficult. A decision on location of the facility will also have to be made.

7.3 So far as United Kingdom funding is concerned, the first formal discussions will occur at the relevant Subject Committee of the Research Council concerned. They will arrange to study both the demand for the facility from United Kingdom users and the probable costs of participation. Such a study must be thorough, and may spread beyond the normal scope of the Subject Committee or even the Research Council; and it runs in parallel with similar work in other countries. As the scheme begins to reach the status of a realistic proposal, and if it is so large as to distort existing budget allocations between research councils, it will be put first to ABRC and then, if new money is needed, to the DES. At this point it will also normally come to the attention of the Cabinet Office who ensure that all inter-departmental matters are considered.

7.4 Thus we were told by SERC, "Where more substantial resources, or political considerations obtain, the (Research) Council needs to work with overseas partners under an intergovernmental agreement ... At the lowest level, this involves clearance with the Department

of Education and Science at official level. Where circumstances demand, as was the case with the ESRF, Departmental Ministers are informed or consulted and may play a role in discussion or negotiations with their opposite numbers in other countries. They will also consult Ministerial colleagues in other Departments directly involved, such as FCO and Treasury. Ultimately issues with major political implications such as United Kingdom membership of CERN, or the level of resources for the science programme of ESA or EC R&D, require inter-Ministerial discussion at the highest political level, and can also be subject to advice from senior advisory bodies such as ACOST. At these levels, the closest possible interaction is necessary between the Council and Departmental officials" (p 75). DES described the system in broadly similar terms (p 121).

7.5 The Cabinet Office has recently issued guidelines on the matters to be considered before undertaking commitment to international collaboration, with a view to ensuring that matters brought to them will have taken the principal major factors into account. These guidelines (pp 45–6) are intended for Research Councils and Departments and consists of brisk advice on assessing the case for United Kingdom participation, on negotiating terms of participation and on monitoring and evaluation.

7.6 During the first formal discussions by the research council of a proposal for participation in a large centralised programme, consideration will also be given to the possible sites for the Centre. Most scientists see significant advantages in having a facility sited in the United Kingdom, since it gives them easier access, though Government witnesses seemed more agnostic. Our attention has been particularly engaged by evidence on three aspects of the United Kingdom's participation in large facilities—the appropriateness of the mechanism of response; the role of the Cabinet Office guidelines; and the national attitude to hosting large facilities. (The budgetary consequences of paying the costs of large facilities denominated in other currencies are dealt with separately in Chapter 8.)

7.7 Criticism of the mechanism of response came from many quarters and focused on the adequacy of the existing procedures and the speed with which they worked. The Royal Society was the principal critic of present arrangements, claiming that "An invitation to participate may be received by an Embassy overseas, by a Government department, by a research council, by an academy or by an individual research unit. When the request comes, the proposal may still be in an early, imprecise form. All this makes it difficult to respond quickly and efficiently to proposals for ISPs. We are not aware of any single mechanism to prepare a United Kingdom response to proposals for ISPs. This absence of clear procedures can lead to delays in responding, giving the impression to the international community (yet again) of British reluctance to take a role in international co-operation" (p 56). They went on to complain of a "procedural vacuum" which had caused decisions to be "bedevilled by inter-departmental rivalry leading to diffusion of responsibility and slow decision making" (p 58). It emerged in oral evidence that they had particularly in mind the two- or three-year delay in responding to the US proposal, via the UN and the FCO, for a collaboration (not involving a large facility) to be called the International Decade of Natural Disaster Reduction (IDNR); and the delays in responding to phase two of the Ocean Drilling Programme (QQ 201–202, 205).

7.8 The remedy, in the Royal Society's view, lies in the creation by the Government of a "standing group" to advise it on proposed international programmes. Such a group would have power to call in appropriate advisers to assist it in formulating such advice. Alternatively and subject to the provision of the "necessary resources", the Royal Society would fill the role of a standing group (p 58).

7.9 The Medical Research Council came near to expressing views similar to the Royal Society. They suggested that an "inter-agency committee" might help to ensure that international programmes, especially the EC Framework Programme, were better considered in the context of United Kingdom scientific priorities. But so far as the actual decision making was concerned, MRC maintained that the "machinery currently employed is appropriate to the main objectives of each ISP, ie Cabinet Office for fundamentally politically driven programmes, such as the EC Framework programme, and Research Councils for scientifically driven programmes, such as those within ESF" (p 207).

7.10 Most other witnesses were opposed to the creation of an extra tier in the decision-making machinery. Sir Mark Richmond of SERC said that "... we would be rather concerned to see a further level of bureaucracy put into the system somewhere" (Q 295). Nor was the Royal Society's view shared by DES (Q 424) or DTI (Q 408). Nor was it echoed by individual scientists. Professor

Miller of Edinburgh University, currently Director of Research at ESRF, found the machinery "entirely adequate" (pp 311–14). Furthermore it was a continuous theme in our evidence that decisions on the balance of expenditure amongst the pure sciences should be determined by the scientific community itself.

7.11 On the other hand, it was put to us by a number of witnesses that the whole sequence whereby a project, even when well formulated, needs approval first from the individual Research Council, then from ABRC and DES, and then the Cabinet Office, is slow and difficult for the proponents to follow closely, and still harder to influence. We heard from Sir David Phillips that the Cabinet Office and ABRC did discuss these collaborations. "The Chief Scientific Adviser in the Cabinet Office, now Professor Stewart, is an assessor on the new ABRC and plays a full part in the debate, and he does involve me and the heads of research councils and other members of these organisations in discussions about European and other programmes; but that is essentially in a consultative, advisory mode" (Q 630).

7.12 For some witnesses this was clearly not enough. Sir Hermann Bondi complained of "the slowness of governmental decision taking (eg the case of the Canadian radarsat)" (p 279). Mr Roy Gibson also saw timing to be crucial to the success of a collaboration and the United Kingdom's participation within it. He urged speedy action on three fronts:

"(1) Fundamental to a wise decision on whether or not to join an ISP is the early creation of a competent national group to evaluate the proposed programme and to examine alternatives. At this stage it might still be possible to influence the programme more in the direction of the United Kingdom's interests.

(2) Send a first class team as early as possible to participate in the formulation of the programme. Do not rely solely on voluntary or ad hoc for this phase: good advice costs money.

(3) An early decision, at least in principle, gives the negotiators more influence and the possibility of maximising the value of participation. Vacillation and uncertainty, particularly during a period where the United Kingdom is so often—especially in Europe—considered as a spoiler, is worse than a clear negative decision" (pp 329–30).

The Royal Society's views were quoted in para 7.7 above. SERC admitted that though they did now have delegated authority to spend up to £20m capital without further reference (Q 294) there were delays in determining the response to "rather grand and different programmes" where responsibilities were diffused (Q 298). Sir Robert Wilson described how decision-taking time had now extended to several years for some projects. Delays were not all on the United Kingdom side. The European Space Agency had recently taken four years to choose a design study for a project (Q 599).

7.13 There was also evidence that the Cabinet Office structure was simply not understood or known about. Professor Sir David Weatherall wrote, in connection with his experiences over the Human Genome Organisation, "I don't think government was involved at all in this and I suspect that those who were trying to do it, and who eventually succeeded through one of the charities, were unaware that there was a machinery for doing this through government, if indeed there is" (p 366).

7.14 Moreover it emerged both from evidence received and from our visits to Bonn and Paris that the United Kingdom's sequential system was widely perceived there as being slow to respond to international collaborations. Because of the co-ordination of scientific activity and the centralised science budgets under the science ministries in France and Germany such problems did not arise. The main figures in the decision-making process would all fall within the BMFT in Germany and the MRT in France.

7.15 The Cabinet Office's "Guidelines for Future International Collaboration" were well known to the Research Councils and Government Departments who gave evidence. But they were almost completely unknown to practising scientists and to industry (Kendrew p 341). They were considered by some to be incomplete. As NERC wrote, "NERC welcomes these guidelines, and supports them in principle and in practice. Howevever, guidelines must be seen as that. They are no more and no less than a framework in which to operate; each case needs to be looked at" (p 91). And as one academic witness put it, "The financial aspects of ISPs are extremely difficult for universities, and national guidelines on costing would be very helpful" (Turner p 364).

7.16 Conflicting evidence was received as to the desirability of hosting large facilities. The scientific community were almost unanimous in their support for the location of large facilities on United Kingdom soil, not only for the ease of access it offered them and the intellectual benefits it brought to the host country, but for the secondary advantages too—the employment and training offered to locally engaged technical staff; the employment offered to unskilled workers; the economic effects of salary spending, tax revenue and the inflow of overseas funds; and the advantages to United Kingdom contractors for buildings, infrastructure and equipment (SERC p 73; Royal Society p 56; Wilson pp 183–192; Thompson pp 363–4; Queen's Belfast pp 276–7; Miller pp 347–9). The Fellowship of Engineering singled out the benefit of improved technology in local industry and cited the effects of the location of JET in the United Kingdom on magnet and coil design and manufacture (pp 321–4). SBAC thought that industrial infrastructure of the host country is enhanced and urged that "UK should actively seek to host as many facilities as is compatible with its overall strategy" (pp 360–1).

7.17 This presumption of overall benefit is not, however, shared by the Government. The Treasury, when asked whether the hosting of large facilities by the United Kingdom was to be encouraged or discouraged, said that they had "... a fairly neutral position on this. Our principal concerns are the proper control of spending and value for money of the projects and those are the criteria we bring to bear when a project comes to us" (Q 45). The Department of Energy were also insistent that the benefits from the large facilities for which they have responsibility—JET—could be measured only in scientific terms and while there were advantages in terms of employment and contracts, there were disadvantages in the opportunity costs on the local economy, the host country 10 per cent premium, and the decommissioning costs. Thus it was "very difficult to produce any quantifiable statement of the advantages and disadvantages other than the purely scientific ones " (Q 508).

7.18 This agnosticism was not shared by the French and German governments. In Germany we were assured that, while no attempt had been made to impose cost benefit analyses on large facilities, they were nonetheless deemed to be economically as well as scientifically advantageous to the host country. The improved prospects for training of manpower, of industrial spin-off and of local employment were all cited. Indeed, industrial and employer trade associations had done much to publicise the opportunities offered by large facilities for industrial contracts with the result that German firms fared much better than United Kingdom firms in gaining contracts with CERN, though neither country was in fact the host.

7.19 In France, while there was debate with the Treasury on infrastructure costs, large facilities were also assumed to be advantageous for the same reasons as we heard advanced in Germany. No cost benefit analyses appeared to have been made—not because they had not been thought of, but because it was considered that no sensible conclusion could be arrived at.

7.20 The United Kingdom scientific community considers the Treasury line to be negative, rather than neutral, by comparison with the more positive attitude of France and Germany. In the words of the Chairman of the SERC, "the French ... driven very much from the top, see it as a matter of national prestige to have a number of these facilities and ... are not as assiduous as perhaps we would be in doing a hardnosed financial cost benefit analysis". If they did, he thought they took much wider considerations into account. Sir Mark Richmond added that he thought in the United Kingdom the emphasis was on costs rather than value (QQ 323–327). For the Chairman of the ABRC it was "rather strange that in some countries, France particularly, there is seen to be an overall national benefit in hosting international projects ... whereas in this country the Treasury take the view that there is no macro-economic benefit in hosting such international ventures." He found it surprising that countries which were scientifically comparable should come out with views which were so directly opposed on this question, and it seemed to him that the United Kingdom should "think more seriously about hosting international scientific projects" (QQ 641–2).

7.21 We also heard evidence that there was no supra-national forum in which development of new work at large facilities could be considered in the context of what was already being conducted at existing national facilities. Professor Peter Day, Director of ILL, foresaw a danger that developments there would take place without taking into account work done at the United Kingdom's ISIS facility (Q 777). He also thought that the long-term future for neutron sources in Europe needed to be considered. DGXII of the EC Commission was not the appropriate forum for discussions of this kind (QQ 777; 785). Nor was ILL's own Steering Committee appropriate for taking a broad overview of requirements (QQ 804–815).

COMMITTEE OPINION

7.22 The Committee is concerned about four aspects of the machinery for responding to calls for major collaborations involving large facilities:

(a) it would appear that on occasion proposals emanating from other governments or IGOs have been mishandled, in that no-one was responsible for putting them up for consideration by the scientific community and for grants;

(b) it seems that whenever proposals for large facilities exceed the means of a single research council or department and involve reference to ABRC, DES, the Cabinet Office and Treasury, response time can be very protracted; and

(c) funding of facilities by Government departments has repercussions for science funded by research councils and can have a significant effect on the balance of the national scientific effort and the planning of future research council activities; and

(d) there is no forum which takes a supra-national strategic look at the work of large facilities.

7.23 So far as concerns (a) to (c) above, we do not consider that the remedy lies in creating an additional tier of government by way of a co-ordinating body of some kind. We agree with those witnesses who found the present machinery of government appropriate. We consider that funding choices which determine the balance of basic science should rest with the ABRC. And we consider that other questions of co-ordination must continue to rest with the Chief Scientific Adviser and the Cabinet Office S&T Secretariat. Our concern is that this machinery should work expeditiously.

7.24 In our opinion, the relationship between the Cabinet Office S&T Secretariat and ABRC, personified in the Chief Scientific Adviser and the Chairman of ABRC, is central to any improvement both in the communication to the research community of proposals for collaboration received from other governments or IGOs ("top down") and in expediting authority to fund proposals received from the scientific community ("bottom up"). We therefore recommend that Cabinet Office ABRC consultations on specific proposals be intensified. The Cabinet Office should inform ABRC, and thus all research councils, immediately of all proposals of which they or any other Department of State may have notice. Equally, it is for ABRC to consult the Cabinet Office on any proposed participation in international programmes which may have come up through the research councils before any bid for further funds from the Treasury is made as part of ABRC's annual advice to the Secretary of State for Education and Science in the course of the annual PES round.

7.25 Where proposed collaborative projects are supported by Government departments rather than by the research councils, we recommend that the Chief Scientific Adviser should invite Chief Scientists of Departments to take the advice of ABRC whenever a proposal might have a significant impact on a significant sector of a scientific activity. This would mitigate the effect of the decision that Departmental Chief Scientists do not sit on the new ABRC.

7.26 We consider that the Cabinet Office Guidelines, though meant originally only for Departments and Research Councils, have an insufficiently wide circulation and offer little in the way of practical procedural advice. We recommend that they should be made available through DES to the universities and the scientific community as a whole. DES should append to the Guidelines procedural advice to scientists or groups of scientists wishing to know how to advance a proposal as rapidly as possible.

7.27 We call attention to the difference between the British Government's attitude on hosting large facilities which seems to us to take account only of quantifiable costs and that of France and Germany. The uncertainties which exist over the decommissioning costs of JET should not be allowed to overshadow what we consider to be the obvious scientific, technical, economic, educational and cultural benefits of hosting large facilities. We therefore urge the Government to do more to seek out opportunities for hosting such facilities.

7.28 We note that, outside the European Community, no supra-national forum exists to take a strategic overview of the work of large facilities and their development in the context of work

done in national facilities. We agree that DGXII is not the ideal body to assume this role on the grounds that it is insufficiently representative of European countries and has only limited expertise in the field of large facilities. We note that the scientific community has now evolved common organisations at European level: the research councils have set up the ESF and scientists and other scholars (aided by certain national academies) the Academia Europaea. We consider that it now behoves national governments to form a ministerial group—on the lines of COST—capable of addressing these questions, and taking advice from the scientific organisations.

PART III: SECONDARY PROBLEMS OF RESPONSE

CHAPTER 8: BUDGETARY AND FINANCIAL CONSEQUENCES OF INTERNATIONAL SCIENTIFIC PROGRAMMES

8.1 United Kingdom participation in international programmes has financial consequences for the participating institution whether it be a government department or institute, a research council, or a university department. Someone has to pay. However certain United Kingdom financial practices set United Kingdom participants at a disadvantage when compared with overseas competitors and the consequences condition the response of United Kingdom scientists to international projects. We refer, in the case of EC programmes, first to "additionality" and "attribution" and secondly to the standard form of contract. In the case of non-EC programmes requiring cash contributions denominated in foreign currency, United Kingdom practice on exchange rate fluctuation causes difficulty to participating bodies.

Attribution

8.2 The Treasury's handling of Community funds under the system of attribution was examined by the Select Committee on the European Communities in their report *A Community Framework for R&D* (1989–90, HL Paper 66). This report was debated on 28 January and we have had the advantage of reading the reply of Lord Hesketh (HL Debates cols 510–519). The system of attribution applies only in respect of Community programmes. Funding of all other international collaboration in science and technology is on a different basis. The principle of attribution is closely linked, in the British context, to that of additionality—the extent to which Community support has "a genuine additional" impact and results in "at least an equivalent increase in the total volume of official or similar" funding in the member state concerned. (This definition relates to payments under EC Structural Funds (Article 9 of Resolution 4253 88).

8.3 The practice as described to us by the Treasury is that for the purposes of public expenditure control the Treasury attributes funds received from Community R&D progammes to specific departmental budgets in line with their domestic policy responsibilities, and then in the subsequent public expenditure round adjusts those budgets to take account of the Community funds which have been attributed. In the words of the Treasury "... attribution of responsibility for particular R&D programmes goes to departments in line with their domestic policy responsibilities. Those departments are then responsible for briefing and negotiating upon and advising on the content of European Community programmes. Each department also has an expenditure allocation, a financial allocation, related to its sponsorship responsibility, if you like, for European Community programmes. If expenditure on those programmes—on the programmes for which the department is responsible—exceeds the predetermined level of provision which the department has, then that department is expected to contribute towards that excess European expenditure. In effect, the department is expected to meet the net public expenditure cost of the United Kingdom's contribution to the EC expenditure above the predetermined level. But the existence of the predetermined level means that European Community research programmes will always give rise to additional public expenditure in the United Kingdom; and since our receipts broadly equate with our contribution, that additional public expenditure will mean an increase in the resources available to research institutions in this country" (Q 3). It emerged in Lord Hesketh's speech (see para 8.2 above) that the predetermined level was, in fact, the level of spending in 1984.

8.4 It is left to departments to decide for themselves how to make the adjustments which are required, and a department can also bid to have restored any loss of funds which it is scheduled

to suffer. But unless it succeeds in such a bid, a body in receipt of Community funds may find that the following year its support from central government is reduced. Community funds are thus not fully additional to the national government funds otherwise available, and they might in some cases not be additional at all. The Select Committee on the European Communities found this state of affairs unsatisfactory. They gave five reasons for their opinion and the evidence we received supports their principal findings.

8.5 In the first place, outside the Treasury the concepts of attribution and additionality are not well understood. The Chairman of SERC told the Committee that the Treasury's evidence to the Committee did not leave him with a clear understanding of how attribution worked (Q 290). The Chairman of ABRC doubted whether outside the Treasury "there are 100 people in the country who actually understand what happens in practice. I am not sure that I would count myself among that number. Nevertheless, there are undoubtedly beliefs about it which affect the attitude of scientists to getting involved in European programmes" (Q 620). He suggested that "someone should put out a popular guide as to how the system works so that we know what is going on" (Q 621). Others shared similar views (Q 901). Departments' views were more muted. The DTI, the department most affected thus far by the application of the attribution principle, told the Committee that they were "not conscious yet of any major impact on national programmes". The DTI expected to negotiate toughly with the Treasury in order to ensure flexibility in future allocations to the department. But they accepted that with Framework Programmes increasing in size, some effect was eventually bound to arise out of the imperfect match between what they would have liked to see in a Community programme and what was actually included (Q 379).

8.6 A second criticism was that the attribution system could not be independently monitored by Parliament or any other external body. The Treasury told us that the Third Framework Programme would cost the UK some £750m over 7–8 years, with UK receipts over that period also likely to be about £750m. The Treasury expected "with the application of current arrangements" that departmental programmes would in consequence be reduced by about £500m over the same period. It followed that 30–35 per cent of Community receipts would be genuinely additional. This was said by the Treasury to be not by design, yet also "not entirely arbitrary" (Q 63); rather it was "something that occurs as a result of the scale of the programme itself and the way in which the controls operate" (Q 56). Lord Hesketh (see para 8.2 above) considered that if continued spending under the Second Framework Programme was included, the additional spending was in fact "much more than the 30p–35p in the £1" (col 514). But in the light of Lord Hesketh's remarks concerning the information laid before Parliament on public expenditure, it is still not possible to monitor the processes which result in this particular level of additionality rather than some other one, even though expenditures and receipts may be set out in a manner that satisfies the Government.

8.7 A third concern was that the system of attribution might lead to a distortion in the priorities of the United Kingdom scientific community. This could arise because, whatever the quality of advice tendered to the Government within the United Kingdom, the United Kingdom's ability to influence policy in Brussels is ultimately limited to one voice among twelve in the EC Council of Ministers. Decisions made there might subsequently, as a result of the practice of attribution, lead to a loss of United Kingdom funds for scientific programmes judged worthy of national support. The ABRC Chairman said he was not yet aware of any distortion in United Kingdom priorities resulting from the Framework Programmes and the SERC Chairman also stressed that it would be the Third Framework Programme which for the first time would significantly affect SERC (QQ 622, 277). Sir Mark Richmond recognised that the costs of Framework Programmes had to be met from within the overall science budget (Q 274). What he wanted was to be party to the decisions which it would eventually fall to SERC to pay for: "We have yet to be assured ... that enough notice is taken of us" (Q 275). MRC also thought the attribution system was "operated rather rigidly" (Q 688). MRC said they were not directly involved: the DES acted on their behalf, so they felt rather remote from the process. For their part, NERC saw a "potential conflict between the need to seek funding to offset attribution and the additionality concept which requires that funds are only sought over and above the national programmes." These two issues, NERC thought, "could combine to have a major impact on research priorities" (p 91). The DES view was that there existed "a logic and rationale in the government's position", and the DES also believed that the Research Councils had been "fully consulted in the United Kingdom's negotiating objectives ... and to a considerable extent had been kept up day-to-day with the discussions as they take place" (Q 417). The DES considered that any damaging impact on United Kingdom priorities was "something of a theoretical argument" which in the event might not emerge so starkly as had been suggested (Q 416).

8.8 Our fourth concern shared with the European Communities Committee was that, while overall United Kingdom expenditure on and receipts from the Framework Programme could be expected to be in broad balance, at about 20 per cent of the total, particular recipients had reason to fear that such success as they enjoyed in winning European Community money might later be penalised through the loss of domestic funds. As Sir Francis Graham-Smith told us, "The EC has its funds available and it has its own methods of distributing them. It does not seem reasonable that any particular distribution that the EC decides to make would reflect, pound for pound or ecu for ecu, into the research council to whom that activity might have been attributed in this country. It seems to be a stultifying position which will, of course, discourage the relevant research council from supporting the activity in the first place" (Q 264). The Treasury told the Committee that the amount of money which a department could lose under attribution was "not related to the scale of the receipts of research institutions for which that department is responsible". But the Treasury also acknowledged that a research institution might receive only modest amounts and yet see its budget affected by significant reductions in a department's programme (QQ 14, 15). The DES argued that the figures for attribution offset were "really quite small in relation to the overall size of the science budget" (Q 421) and the complaints about the system related, as they saw it, "more to the future than to the present" (Q 420). There was flexibility within the DES as to how the offset was actually made against particular departmental budget heads, so that deductions could be made before sums were distributed. As the importance of the Framework Programmes for the science budget grew, the DES saw two mechanisms which would enable a decision to be taken as to the overall effect of the Framework Programmes on the total of science expenditure available. These were through the setting of the baseline of expenditure, and via discussions with each individual department as to whether additional money above the baseline should be allowed from central resources. The DES rejected the notion that particular Councils had been hit by particular successes in Europe: "it does not work like that" (Q 421).

8.9 The final point to which the European Communities Committee drew attention was that the Treasury choose to regard universities as part of the private sector, so that from the Treasury perspective, the Framework Programme amounts to a substantial transfer of funds from the public to the private sector. The European Communities Committee found the Treasury's decision to assign the universities to the private sector a curious one.

8.10 In addition, we point out that the failure to observe 100 per cent additionality through attribution in respect of Community funds originally arose in connection with Community regional policy. In the case of regional policy, attribution can help to ensure that priorities arrived at in the United Kingdom are not seriously altered by allocations made later by the Commission. Indeed regulation 4253/88 on the Structural Funds provides a qualification that such increases in total national spending as may occur with Community support may take into account "the macro-economic circumstances in which the funding takes place". Thus some form of attribution would not be inconsistent in connection with the structural funds. But in the case of science and technology it is open to Brussels to introduce a programme or project which otherwise might not win support at all in the United Kingdom. To the extent that this occurs (see para 8.7 above), it would be quite wrong for the United Kingdom Research Councils, and through them their clients, to be penalised. Some witnesses saw current practice as amounting to taxation without representation.

8.11 On our visit to Germany and France we asked witnesses whether similar practices obtained in those countries. In Germany, although in theory it was possible for domestic spending to be adjusted to take account of EEC spending, the level of spending at which any adjustment would bite had yet to be attained. Negotiations on the budget of the Framework Programme had to be agreed with the Finance Ministry, but thereafter there was no further adjustment of any kind. Thus there was 100 per cent additionality and the question of attribution did not arise.

8.12 In France, it was acknowledged that the overall R&D budget, out of which French contributions to the Framework Programme were made, was adjusted to some degree to take account of that contribition and of the likely receipts. But the stage at which this adjustment was made was so remote from specific spending programmes that no losers could be identified. There was no attribution and no sense of grievance could be discerned.

8.13 In Belgium, "there is no formal mechanism, but the initial calculation of departmental budgets involves foreseen expenditure on EC programmes leading automatically to a corresponding reduction in domestic spending on the sector for which the additional contribution was destined" (Hesketh see para 8.2 above).

Contracts

8.14 The Committee were impressed by the way in which universities seemed anxious to expand their receipts through EC contracts, particularly under the Framework Programme, and by the steps which they were taking to receive early notice of Community initiatives (see para 6.6 above). But we received a considerable amount of evidence of practical contractual difficulties which universities encountered in EC collaborative work (Kingman pp 342–4; Dawson p 301; Leeds p 354; Heriot-Watt pp 359–60; Birmingham p 363; Queen's Belfast p 354; Strathclyde p 362).

8.15 The EC model contract allows universities to choose one of two funding methods—50 per cent Full Economic Cost whereby the EC pays half the total cost of the project which includes an overhead rate which must be agreed with the EC, or Marginal Cost whereby the EC pays all the marginal costs of the project plus an overhead of 20 per cent . The chief complaint related to the treatment of overheads costs under the EC's Marginal Cost Contract. European Community programmes allow only a 20 per cent overhead on a marginal cost contract, whereas a figure of 40 per cent has now become the minimum acceptable on a Research Council contract. It follows that a university joining a Community programme in effect subsidises Community research. The Vice Chancellor of Bristol University suggested that the European Community be urged to create a composite rate, though it is acknowledged that such a rate would be advantageous only if it were high enough to enable all universities to cover all their costs (pp 342–4). As things stand, in the words of the ABRC Chairman, "accepting a European contract imposes a burden on the host university and if they accept too many of those they go bankrupt" (Q 655). Indeed, the Deputy Principal of Heriot-Watt University informed us that in his view his university was "unlikely to seek to participate as fully in future EC R&D projects as it would wish" (pp 359–60).

8.16 We were told that the CVCP and DTI were currently engaged in negotiations with the Commission to agree on a methodology which would enable United Kingdom universities to opt for the attractive 50 per cent Full Economic Cost Contract but had not yet met with success. Indeed, the Commission had refused to accept the methodology of the 1988 CVCP Hanham report on costing. The main areas of difficulty relate to the separation of time spent by university staff on teaching from that spent on research and on the way in which the costs of existing buildings are accounted for (Belfast pp 276–7; Fasella Q 856). Professor Fasella of DG XII of the Commission told us that it was now up to the CVCP (and CDP) to come forward with further proposals (Q 858).

8.17 Other difficulties with European Community contracts are the way in which buildings and equipment are allowed for, the negotiation costs of successful bids, the effects of inflation and exchange rate fluctuations, and the mechanics of VAT recovery (Kingman pp 342–4). It can also be extremely frustrating for a university, having carefuly costed a programme and bid successfully, to find that the Commission has then substantially cut back the budget. It emerged in evidence that continental universities did not experience the same degree of difficulty with regard to EC contracts, largely because they are better funded in the first place (Q 862).

8.18 While witnesses looked to the Commission to reconsider their practice on overheads, they felt that the United Kingdom government might be able to assist in meeting shortfalls in the funding of equipment, in meeting negotiation, inflation, exchange rate and wages costs, and in simplifying VAT recovery.

Exchange fluctuations

8.19 Where a contribution to a large facility is denominated in currency other than sterling the effect of movements in the exchange rate have to be borne by the contributing agency. In the cases where the contributing agencies are research councils adverse movements in the exchange rate can have unforeseen and serious consequences for their cash-limited budgets (Q 885).

8.20 The Royal Society told us that fresh thought needs to be given to ways of protecting research council budgets from large fluctuations in currency exchange rates. The effects of such fluctuations often fall disproportionately on the small proportion of research council budgets assigned for flexible responsive-mode funding (p 58). SERC, of all the research councils, had particular cause for complaint. The cost of the United Kingdom subscription to CERN which fell to SERC and amounted in 1990 to £51.3m had risen by about one third in real terms between 1985 and 1988 (p 76).

8.21 To some extent the effects can be mitigated by forward buying of currency, and some relaxation has been allowed in the hitherto very constricting rules on carry-over of funds, but it remained "the largest single difficulty for the Council" (ibid). However the Chairman of ABRC suggested to us that the Research Councils had "perhaps, from time to time, not been as expert as they might have been" in buying forward on the foreign exchange market (Q 640). The Treasury's view is that the uncertainty caused by currency fluctuations is one of the factors that a Research Council or other body should take into account in deciding between an international and a domestic programme in the first place. They consider that whatever the movement of the currency, a Research Council "would be unlikely to find great difficulties in coping with the effect of currency movements" (QQ 33, 39). We comment on this below in para 8.35.

8.22 The disquiet felt by many witnesses at home led us to look carefully at what happened in France and Germany. In both countries, the bill for large facilities fell to the overall science budget. In Germany the allocation came as a lump sum through the BMFT. In France, three large facilities were paid for via their Foreign Office—CERN, ISO and EMBL. This reflected the political level at which these organisations had been set up. But their budgets were negotiated within the overall research and development budget prepared by the MRT. Sums were allocated in the same way to any other (non-MRT) ministries with science spending. The Foreign Office budget for large facilities was one of these allocations. Nevertheless it was MRT which negotiated estimated amounts with the other departments, and the other departments which managed subsequent fluctuations.

8.23 Both in France and Germany the effect of currency fluctuations upon contributions to large international facilities was covered by the Treasury. In Germany, this protection was achieved (a) by actualising the budget only 3 weeks before the end of its final stages in parliament; (b) by looking for further resources in the first instance within existing departmental budgets; and (c) by being willing to meet any further payments which departments felt unable to bear by providing additional funds under supplementary estimates.

8.24 In France, the mechanism was less clear. But the fact that payment for the large facilities like CERN fell to the Foreign Office Vote meant that any increase in payments through currency movements did not impinge *directly* on domestic science spending.

Salaries

8.25 The evidence we received on salaries centred on the effects on collaboration in general of the lower salary levels of United Kingdom scientists than those obtaining in competitor countries.

8.26 On the question of lower salary levels, evidence was anecdotal. It was reported to us that there had recently been difficulties over the remuneration of German scientists visiting the United Kingdom. On our visit to France, by contrast, officials told us that they considered their salaries to be broadly comparable to those in the UK. A recent report by SERC has found that "compared to the British researcher, the German researcher carries with him or her nearly twice the research expenditure, and the French researcher over 50 per cent more" (Research in the United Kingdom, France and West Germany: a Comparison, SERC, 1990, p 8). It is not clear how this differential is distributed between better equipment, more support staff and higher salaries, but all three factors are likely to be involved.

8.27 Salary differences could, other things being equal, make German, French and other European scientists disinclined to accept appointments in the United Kingdom unless these were made at their national salary levels, while encouraging United Kingdom scientists to seek opportunities on the continent. But other things are not equal and foreign scientists continue to see career benefits from working with British scientists in United Kingdom centres of excellence. Indeed, the United Kingdom may even be the most popular country to visit within Europe from other European countries.

8.28 In the longer term there is, however, a danger that a deterioration in the relative standing of United Kingdom science might make collaboration with the United Kingdom unattractive to foreigners. We were disturbed to be told by the Chairman of the ABRC that although the United Kingdom's standing in world science remained very high, he feared that it was declining. The crude measures available suggested to him that "our levels of basic science are tending to fall both

in quantity and in impact", though he stressed this was from a level formerly second only to that of the United States (QQ 634, 635). If the decline of United Kingdom science, which Sir David Phillips thought might have been in progress for fifteen years or more, were to continue indefinitely then naturally the United Kingdom might eventually become much less attractive to foreign scientists, and more scientists would want to go abroad.

Committee Opinion

8.29 We take the complaints of the scientific community about United Kingdom practice on additionality and attribution very seriously. Although the United Kingdom's receipts under the EC Framework Programme amount to only some 3 per cent of the total United Kingdom annual R&D expenditure, we think that the unpredictability and inflexibility of attribution is a major disincentive to scientists wishing to participate in EC collaboration. It holds recipients of EC funding in fear that they or their colleagues will be penalised for their success in attracting EC funds. The more spending under the Framework Programme moves into different and more 'basic' areas of science, the wider this unhappiness will be spread.

8.30 We should prefer that, as in France, such adjustment of national budgets as may be made by the Treasury should be done in a manner and at a level that does not impinge on specific programmes. But we recognise that given the fragmentation of science spending in the United Kingdom this would be difficult. Given that science spending forms merely a part of the much larger expenditure of departments like DES and DTI it is hardly surprising that those departments will wish to attribute any downward adjustment in their vote on account of receipts under the Framework Programme to the science element of their vote rather than adjust their spending across the board.

8.31 Were funds received from EC programmes to be regarded by the Treasury as 100 per cent additional to United Kingdom domestic spending then of course the problems of attribution would never arise. To the extent that 100 per cent additionality may not be applied, at least in the near future, there is a need for better understanding of the rationale and operation of the system, by research councils and other recipients and by Parliament. The mechanics of attribution must be explicit, as also should be the process of bidding to recover lost funds. We therefore recommend that the quality of information on the practice of additionality be improved to allow Parliament the option of full scrutiny; and that the procedures for attribution be set out in guidelines and made available to research councils, universities etc.

8.32 So far as concerns the EC Commission Model Marginal Cost Contract and its attendant problems, we are sympathetic to the universities. It is clearly in the interests of the country as a whole, and is much desired by the Government, that the United Kingdom receives its share of funding under the Framework Programme. In our view any practical problems that might impede this therefore merit the closest attention. The issue of overheads costs is a particularly difficult one because of the different practices in different universities; because of the difficulties of separating out costs; and because overseas universities and research centres do not appear to share these problems.

8.33 We note with approval the DTI involvement in negotiating with the Commission the issue of the 50 per cent Full Economic Cost Contract. We urge universities and polytechnics to work out through CVCP and CDP a common position on marginal cost contracts and press their case with the Commission in like manner. While we believe that the situation could and should be improved, we enter two caveats. First, inevitably, the higher the rate of overhead recovery within a fixed programme, the less R&D will be performed. In addition, if overhead recovery comes more nearly to reflect true R&D costs, then (unless the notion of "juste retour" were to be rigorously applied to returns under the Framework Programme, which would be undesirable) the more the United Kingdom could be disadvantaged because of the much higher R&D costs of France and Germany.

8.34 The Customs and Excise should simplify VAT procedures under the EC Model Contracts.

8.35 In some cases there is no alternative to joining in a large international facility if certain types of, usually expensive, science are to be pursued. Unlike the Treasury (see para 8.21) we think that exposure to currency movements is therefore inevitable. We consider that the effect of

currency movements on research council budgets, particularly that of SERC, is such that some relief must be found. We think it grotesque that research councils should be expected to cover their costs through playing on the currency markets, like a commercial organisation. While United Kingdom entry into the ERM can be expected eventually to help to stabilise currency movements, the band within which the pound can move is presently large, at plus or minus 6 per cent. A more lasting problem is that the Swiss franc in which the CERN budget is denominated is not a Community currency. Nor, of course, is the US dollar.

8.36 But the Government's commitment to ERM suggests to us that a remedy is to hand. The government expects in due course to discipline itself to a narrower ERM band, of plus or minus two and a half per cent. We recommend that from now on Research Councils be expected to bear the risks only up to this lower level, with the same liability for movement in relation to the Swiss franc. The Treasury should then absorb all further currency movement, including any which results from revaluation or devaluation of either sterling or the currency of denomination.

8.37 Differences in United Kingdom and overseas salaries do not appear to have had any effect upon the United Kingdom's response to international scientific programmes to date. But the relative decline of United Kingdom science will clearly have consequences for the longer term which will have to be monitored and guarded against.

CHAPTER 9: SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

9.1 The United Kingdom's response to proposals for international scientific programmes does not raise such problems as to merit a radical departure from present arrangements. Despite the fact that, in the United Kingdom, responsibility for the conduct of research and for research spending is diffuse, procedures exist for considering proposals for most kinds of collaboration.

9.2 Nevertheless, these procedures should work better. In our view there is considerable scope for improving the strategic role which, in the absence of a ministry for science, must be performed by the Cabinet Office Science and Technology Secretariat. The quality of the contact between the Cabinet Office and ABRC and the research councils is central to the sound management of responding to proposals for collaboration.

9.3 Financial, budgetary and contractual problems have arisen in recent years in connection with the United Kingdom's participation in international scientific programmes. While they are secondary to the question of response to proposals, we think that in their different ways they are of sufficient significance, when taken with the pressure on university finances, to threaten the quality of response in future years. We particularly dislike the Treasury practice of attribution. We ask the Government to offer some measure of relief to research councils to meet the costs of fluctuation in exchange rates. And we look for early resolution of the impasse that currently exists on the EC standard form of contract, and in particular on the recouping of overheads costs by the universities.

9.4 International scientific programmes, at whatever level they are conducted, are an essential feature of the scientific progress of our nation. They and the scientists who participate in them deserve better treatment than they get. Our specific conclusions and recommendations follow.

Information

9.5 The Cabinet Office should ensure that, in formulating the Annual Review of Government Funded R&D, the research councils and government departments clearly identify their contributions to international scientific programmes. A separate section, which draws together United Kingdom participation, should be included in the Review (2.40).

Informal and Personal Programmes

9.6 Personal and informal collaborative projects are very important to United Kingdom science and will continue to grow in importance as the United Kingdom's relative position in world science continues to fall (4.8).

9.7 The proposed transfer of research money from the universities to the research councils must not result in a diminution of travel money available to facilitate personal collaboration. Research councils and the universities (through CVCP) should meet under the aegis of the Royal Society to review the provision of travel funds to young researchers (4.9).

Formally co-ordinated multi-centred programmes (without funding)

9.8 Programmes initiated by government departments or research councils give rise to no problems of response largely because they have guaranteed access to the budgets of the participants (5.16).

9.9 The EUREKA programme works well and DTI's role in promoting it is to be commended (5.17).

9.10 Research Councils should expedite consideration of applications for funding of projects under programmes promoted by other umbrella organisations (NGOs or IGOs) (5.18).

9.11 Many researchers have unrealistically high expectations of research councils' ability to respond quickly. Potential collaborators should give early notice to, and seek early advice from, research councils concerning both the programmes and the formulation of the competitive case for the use of United Kingdom research money in respect of which applications are to be made (5.20).

Formally co-ordinated multi-centred programmes (with funding)

9.12 The problems associated with the setting up of the Human Frontiers Science Programme suggest that the Cabinet Office Science and Technology Secretariat should strengthen its strategic role in connection with future international programmes, especially with those involving Japan (6.20).

9.13 We note with satisfaction the wide United Kingdom take-up of EC funds under the Framework Programme (6.21).

9.14 To overcome the feeling on the part of the research councils that they lack direct input into the establishment of the Framework Programme, ABRC should in future be asked to give collective advice to the Science and Technology Secretariat, and hence to Ministers, on the 'lines' and their contents. All research councils should be given the opportunity to offer direct briefing to the Secretariat if they so wish (6.23).

9.15 The views of the wider scientific community should also be sought, possibly through the Royal Society and Fellowship of Engineering (6.24).

9.16 Government representatives must be on guard to prevent the scientific quality of EC programmes being reduced by political considerations (6.25).

9.17 Financial provision should be made under each specific programme of the Framework for regular evaluation of projects; the names of evaluators and their findings should be made public; and the Commission should be continuously alert to the need to maintain and enhance the calibre of its evaluators (6.27).

Large centralised programmes and facilities

9.18 There is no need for a new co-ordinating body to oversee the handling of proposals for large facilities. Funding choices should continue to rest with ABRC while questions of co-ordination must continue to lie with the Science and Technology Secretariat (7.23).

9.19 To expedite decision-making, the Cabinet Office should immediately inform ABRC and the research councils of all proposals of which they or any other Department of State may have notice; ABRC should consult the Cabinet Office on any proposed participation in international

programmes which may have come up through the research councils before any bid for further funds from the Treasury is made as part of ABRC's formal advice to the Secretary of State for Education and Science on the annual science budget (7.24).

9.20 Where proposed collaborative projects are supported by departments, rather than by research councils, the Chief Scientific Adviser should direct Departments to take the advice of ABRC whenever a proposal might have a significant impact on a significant sector of a scientific activity (7.25).

9.21 The Cabinet Office's "Guidelines for Future International Collaboration" are not known sufficiently widely. DES should make them available to the scientific community as a whole. DES should append to the Guidelines procedural advice to scientists wishing to advance a proposal as rapidly as possible (7.26).

9.22 We deprecate the Government's negative attitude on the question of hosting large facilities, which seems to take account only of quantifiable costs, and urge them to seek out opportunities for hosting more of them (7.27).

9.23 No supra-national forum currently takes a strategic over-view of the development of large facilities in the context of the activities of national facilities. National governments should form a ministerial group, on the lines of COST, to address these questions taking advice from the scientific organisations (7.28).

Attribution; contracts; currency movements and salaries

9.24 The practice of attribution and additionality in respect of EC programmes is not well understood outside the Treasury; additionality at 30–35 per cent or more has no apparent logic and the system cannot be monitored by Parliament; it may lead to a distortion in the priorities of the United Kingdom scientific community; the inflexibility of its application causes fear on the part of recipients of EC funds that they or their colleagues will be penalised for their success through subsequent loss of Government funds and is a disincentive to United Kingdom take-up of EC funds; and the case for applying a system originally devised for structural funds to science and technology is weak (8.5–8.10).

9.25 For so long as the practice of attribution continues, information about it should be improved to allow Parliament the option of full scrutiny (8.31).

9.26 The procedures for attribution, including the process of bidding to recover lost funds, should be set out in guidelines and made available to research councils and universities (8.31).

9.27 Universities must work out through CVCP and CDP a common position on both 50% Full Economic Cost Contracts and Marginal Cost Contracts in order to renew negotiations with the Commission on the question of overheads costs (8.33).

9.28 Customs and Excise should simplify VAT procedures under the EC model contracts (8.34).

9.29 The effect of movements in exchange rates on research council budgets is serious for those councils with major commitments to large facilities. Research councils should continue to bear responsibility for risks of fluctuation up to the narrower plus or minus two and a half per cent band of the ERM, with similar liability for movement in relation to the Swiss franc. The Treasury should then absorb all further currency movements, including any which result from revaluation or devaluation of either sterling or the currency of denomination (8.36).

9.30 While differences in United Kingdom and overseas salaries have not yet affected the United Kingdom's response to international scientific programmes, the relative decline of United Kingdom science will have consequences for participation in the longer term which will have to be monitored and guarded against (8.37).

APPENDIX 1

Sub-Committee II (International Scientific Programmes)

The members of the Sub-Committee which conducted this enquiry were:

L. Adrian
L. Carver (Chairman)
L. Dainton
L. Flowers
L. Kirkwood
L. Lewis of Newnham
L. Nelson of Stafford
B. Nicol
L. Porter of Luddenham
L. Shackleton
L. Sherfield
L. Taylor of Blackburn

APPENDIX 2

List of Witnesses

The following witnesses gave evidence. Those marked * gave oral evidence.

* AEA Technology

Academia Europaea

Adam, Dr Gordon, MEP

* Advisory Board for the Research Councils

Agricultural and Food Research Council

Beveridge, Dr G S G, Vice-Chancellor, Queen's University of Belfast

Blakemore, Professor C, Waynflete Professor of Physiology, Oxford University

Blythe Esq, G, European Liaison Officer, Bristol University

Bondi, Sir Hermann

Brady, Professor M, Head of Department of Engineering Science, Oxford University

* British Aerospace

British Coal Corporation

* British Council

British Petroleum Company plc

* British Telecom

Brunel University

* Cabinet Office

Cameron, Professor I R, Principal, United Medical and Dental Schools

CERN

CEST

Collins, Dr P D B, Dean of the Faculty of Science, Durham University

Dawson Esq, A, Department of Civil Engineering, Nottingham University

* Day, Professor P, FRS, Institut Max von Laue—Paul Langevin

* Department of Education and Science

* Department of Energy

Department of the Environment

Department of Health

* Department of Trade and Industry

Department of Transport

Economic and Social Research Council

European Molecular Biology Laboratory

European Science Foundation

European Space Agency

* Fasella, Professor P M, Director General, Directorate-General XII, Commission of the European Communities Fellowship of Engineering

Ferranti International plc

* Foreign and Commonwealth Office

General Technology Systems

Gibson Esq, Roy

Graham-Smith, Professor Sir Francis, FRS, Astronomer Royal, Langworthy Professor of Physics, Nuffield Radio Astronomy Laboratories, Manchester University

Hankins, Professor H C A, Principal, University of Manchester Institute of Science and Technology

Harrison, Dr R M, Department of Chemistry and Biological Chemistry, Essex University

Holloway, Professor J H, Head of Chemistry Department, Leicester University

Howarth, Professor C I, Head of Department of Psychology, Nottingham University

Institute of Physics

Institution of Chemical Engineers

Institution of Professionals, Managers and Specialists

International Council of Scientific Unions

International Maritime Organisation

Kendrew, Sir John

Khan, Dr M A, Head of Geology Department, Leicester University

Kingman, Sir John, Vice-Chancellor, Bristol University

Lavington, Professor S, Department of Computer Science, Essex University

Llewellyn Smith, Professor C H, FRS, Department of Physics, Oxford University

Lord, Dr A R, Acting Head of Department of Geological Sciences, University College London

* McCleverty, Professor J A, School of Chemistry, Bristol University

Maynard, Professor A, Director, Centre of Health Economics, York University

* Medical Research Council

Miller, Professor A, European Synchrotron Radiation Facility

Ministry of Defence

Murphy, Professor P G, High Energy Group, Department of Physics, Manchester University

* Natural Environment Research Council

North, Professor A C T, Head of Department of Biophysics, Leeds University

* Oakley, Mr B, CBE

Ordnance Survey

* Overseas Development Administration

Queen's University of Belfast

Roach, Dr P J, Department of Linguistics and Phonetics, Leeds University

* Royal Society

* Science and Engineering Research Council

* Science Policy Research Unit

Scully, Dr C, Department of Linguistics and Phonetics, Leeds University

Sheffield University

Shore, Dr K A, School of Electronic and Electrical Engineering, Bath University

Small, Professor J R, Deputy Principal, Heriot-Watt University

Society of British Aerospace Companies Ltd

Strathclyde University

Taylor, Dr F W, Head of Department of Atmospheric, Oceanic and Planetary Physics, Oxford University

Thompson, Professor M, Vice-Chancellor and Principal, Birmingham University

* HM Treasury

Turner, Professor K J, Department of Computing Science, Stirling University

Universities Funding Council

Ulster University

* Wilson, Professor Sir Robert, CBE, FRS, Head of Department of Physics and Astronomy, University College London

Wand, Professor I C, Head of Department of Computer Science, York University

Weatherall, Professor Sir D, FRS, Institute of Molecular Medicine, Oxford University

Weinstock, Lord, GEC plc

APPENDIX 3

Letter of invitation to witnesses

18 *June* 1990

SUB-COMMITTEE II—INTERNATIONAL SCIENTIFIC PROGRAMMES

The Select Committee on Science and Technology have appointed a Sub-Committee, under the chairmanship of Lord Carver, with terms of reference "to consider how the United Kingdom responds to proposals for international scientific programmes".

The Sub-Committee's investigation will extend across the whole field of international civil scientific and technological research programmes which have specific objectives laid down. It will include any programme which derives its funding wholly or partly from government sources and the government element in industrial collaborative research and development. The inquiry will consider programmes initiated from within the UK as well as proposals coming from overseas. Attention will also be given to schemes for the exchange of personnel and information.

The Sub-Committee invite you to submit written evidence to them on any matters relevant to their terms of reference and in particular on the following issues:

(i) The advantages and disadvantages in joining ISPs, to the UK, to the funding department, and to the participating institutions;

(ii) The advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institution;

(iii) The machinery whereby international programmes are set up and its adequacy in the UK with specific examples where appropriate;

(iv) The technical and financial criteria under which proposals for ISPs are presented and considered;

(v) The forums in which the decision to participate in ISPs is normally reached;

(vi) Government practice and guidelines on ISPs—how they apply and how widely they are known and accepted;

(vii) Treasury rules of additionality and attribution—how they apply in respect of ISPs and the Science Budget and how they treat inflow of foreign money;

(viii) Impediments within the UK to engaging in ISPs, e.g., Treasury rules, relative UK salary scales, housing, travel and family charges, exposure to currency fluctuations, commercial secrecy and intellectual property rights, COCOM restrictions;

(ix) Impediments in other countries to their engaging in ISPs (EEC; Commonwealth; USA; Eastern bloc) e.g., concern with national benefit and protectionism, problems posed by national budgetary procedures.

It may be, of course, that not all of these issues will be of concern to you and that you will wish to concentrate on only those areas in which you have experience.

Evidence should be submitted to the Clerk of Sub-Committee II (International Scientific Programmes), Select Committee on Science and Technology, House of Lords, London SW1A 0PW by Friday 20 July if possible. It would assist the Committee if the evidence were prefaced with an executive summary or precis.

The Committee will decide at a later date whom to invite to give additional oral evidence.

If you have any queries please contact me on 071-219-6075.

R H WALTERS
Clerk of the Select Committee

APPENDIX 4

Visit to Bonn and Paris—9-11 December 1990

List of organisations visited and meetings held

BONN
Federal Ministry of Research and Technology (BMFT)
German Research Association (DFG)
German Aerospace Research Institute (DLR)
European Transonic Windtunnel (DLR)
British Embassy

PARIS
National Centre for Scientific Research (CNRS)
Atomic Energy Commission (CEA)
Ministry of Research and Technology (MRT)
M. Hubert Curien, Minister for Research and Technology
British Embassy

APPENDIX 5

List of Abbreviations

ABRC	Advisory Board to the Research Councils
AFRC	Agricultural Food Research Council
ATSR	Along Track Scanning Radiometer
BAe	British Aerospace
BRITE	Basic Research in Industrial Technologies for Europe
CERN	European Organisation for Nuclear Research
CODEST	Committee for the European Development of Science and Technology
COST	European Co-operation in the field of Scientific and Technical Research
CREST	Committee for European Research in Science and Technology
EEP	European Centre of Public Enterprises
EISF	European Incoherent Scatter Facility
EMBL	European Molecular Biology Laboratory
EOS	Earth Observation Satellite
ESA	European Space Agency
ESF	European Science Foundation
ESPRIT	European Strategic Programme for Research and Development in Information Technology
ESRF	European Synchrotron Radiation Facility
ETUC	European Trade Union Congress
EURAM	European Research on Advanced Materials
EUREKA	European High Technology Programme
EUROMET	European Collaboration on Measurement Standards
FCO	Foreign and Commonwealth Office
FEICRO	European Association of Industrial Research Institutes
GEWEX	Global Energy Water Experiment
GLOSS	Global Sea Level Observing System
IAEA	International Atomic Energy Authority
IARC	International Agency for Research on Cancer
ICSU	International Council of Scientific Unions
IEA	International Energy Agency
IEPG	Independent European Programme Group
IGBP	International Geosphere-Biosphere Programme
IGO	Inter-governmental Organisation
ILL	Institute Laue-Langevin
IOC	International Oceanographic Commission

IRDAC	Industrial Research and Development Advisory Committee
ITCP	International Technical Co-operation Programme
JET	Joint European Torus
JGOF	Joint Global Ocean Flux Study
MOU	Memorandum of Understanding
NATO	North Atlantic Treaty Organisation
NEA	Nuclear Energy Agency
NERC	National Environmental Research Council
NGO	Non-governmental Organisation
ODA	Overseas Development Agency
ODP	Ocean Drilling Programme
OECD	Organisation for Economic Co-operation and Development
PSMSL	Permanent Service for Mean Sea Level
RACE	Research and Development in Advanced Communications in Europe
ROSAT	Roentgen Satellite
SERC	Science and Engineering Research Council
UARS	Upper Atmosphere Research Satellite
WHO	World Health Organisation
WMO	World Meteorological Office
WOCE	World Ocean Circulation Experiment

APPENDIX 6

Some of the principal international scientific programmes in which the UK participates

1. Informal and personal programmes and projects

ESF (European Science Foundation)

Established: 1974. *Location:* Strasbourg.

Aims: By acting as a centre of communication between its member organisations and individual scientists, the ESF seeks to identify areas for beneficial European co-operation in research, to promote the mobility of researchers and to provide the initial stimulus for setting up collaborative programmes. Five Standing Committees (Natural Sciences, Medical and Bio-sciences, Space Science, Humanities and Social Sciences) monitor activities in their respective fields, setting up specialised working groups for specific problems, and co-operate in supporting inter-disciplinary studies and issues of general interest. General scientific activities such as workshops, seminars and colloquia are covered out of a general budget. Additional activities and associated programmes, which are organised as joint research or training enterprises, are funded under special budgets by those member organisations that opt to participate. For example, the ESF Consortium for Ocean Drilling (ECOD) is a partner in the international Ocean Drilling Programme.

Members: 49 member organisations (i.e., academies and research councils with national responsibility for supporting scientific research) in 18 countries: 12 EC states plus Austria, Finland, Norway, Sweden, Switzerland, Turkey and Yugoslavia.

UK members: AFRC, ESRC, MRC, NERC, SERC, British Academy, Royal Society.

ICSU (International Council of Scientific Unions)

Established: 1919. *Location:* Paris.

Aims: to encourage, for the benefit of humankind, international scientific activity which will serve scientific and technological development; to stimulate, design and co-ordinate international interdisciplinary scientific research projects, and scientific education; to co-ordinate the scientific efforts of its national members and the international scientific unions; to enter, through the intermediary of the national adhering organisations, into relations with the Governments of their respective countries in order to promote scientific research in these countries; to maintain relations with the UN and its agencies, and with other IGOs or NGOs, such as WMO, ESA, IAEA, WHO, etc. Instrumental in setting up WMO-ICSU-UNEP Advisory Group on Greenhouse Gases (AGGG) and International Geosphere-Biosphere Programme (IGBP). Together with WMO maintains the World Climate Research Programme (WCRP).

Members: 68 national members; principal scientific academies and national research councils.

NATO SCIENCE PROGRAMME

Aim: to support co-operation and information exchange between scientists and engineers of member countries. The main elements are fellowships/studentships for study abroad, research grants, and study institutes/research workshops. In addition about 10 per cent of the budget is set aside for high priority Special Programmes.

Members: 12 EC countries plus Canada, Iceland, Norway, Turkey and USA.

ROYAL SOCIETY

Aim: the Royal Society co-ordinates the European Science Exchange Programme (ESEP) under which UK postdoctoral scientists and engineers can visit laboratories in 16 countries in Western Europe. Under the programme national scientific organisations in the other countries similarly assist visitors to the UK. The Royal Society also operates a scheme of travel grants for short-term visits overseas, and Guest Research Fellowship scheme, whereby UK researchers can invite overseas researchers to the UK.

2. **Formally co-ordinated multi-centred programmes**

Programmes promoted by IGOs and funded by participant bodies to meet the cost of their participation:

COST (European Co-operation in the Field of Scientific and Technical Research)

Established: 1971. *Location:* Brussels (small Secretariat).

Aim: to promote European collaboration in R&D. COST is an informal organisation which provides a flexible set of arrangements to facilitate scientific and technical co-operation among Government organisations, institutes, universities and firms. The vast majority of COST projects are implemented by combining national efforts. Each state chooses whether to participate in a particular project. Participants pay for the costs of their own research and have full access to the results from other countries. The EC usually provides the costs for co-ordination at the European level. Project proposals are put forward through Government departments and if approved are launched with the signing of a Memorandum of Understanding (MOU).

Members: 12 EC states plus Austria, Finland, Norway, Sweden, Switzerland, Turkey and Yugoslavia.

UK Co-ordinator: Science and Technology Secretariat, Cabinet Office (DTI for industrial activities).

IAEA (International Atomic Energy Agency)

Established: 1957. *Location:* Vienna.

Aims: seeks to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world; to provide materials, services, equipment and facilities; to foster the exchange of scientific and technical information on the peaceful uses of atomic energy; to encourage the exchange and training of scientists and experts in the field of atomic energy; to establish health and safety standards and to prepare a comprehensive set of safety codes and guides covering all aspects of building and operating nuclear power plants; to safeguard against the military use of any materials and equipment provided through the agency.

Funding: regular and voluntary contributions.

Members: 112 states.

IEA (International Energy Agency)

Established: 1974 (OECD agency). *Location:* Paris.

Aims: to improve the world's energy supply and demand structure by developing alternative energy sources and increasing efficiency of energy use; to maintain a system for coping with oil supply disruptions; to promote collaborative energy research, development and demonstration. Four main areas of work are fossil fuels, renewable energy, energy efficiency and nuclear fusion. The IEA provides two ways in which organisations and Governments can participate in its projects: in cost-shared projects each participant contributes an agreed sum to a specific piece of work; in task-shared projects each participant contributes a piece of work out of its own resources and in return gains access to the results of other participants in the same field.

Members: OECD countries (excluding Finland, France and Iceland).

NEA (Nuclear Energy Agency)

Established: 1972 (OECD agency). *Location:* Paris.

Aims: to promote co-operation between member governments in the safety and regulatory aspects of nuclear power and in the development of nuclear energy as a contributor to economic progress, by encouraging the harmonisation of governments' regulatory policies and practices;

reviewing technical and economic aspects of the nuclear fuel cycle; assessing demand and supply, and forecasting the potential contribution of nuclear power to energy demand; exchanging scientific and technical information; co-ordinating and supporting research and development programmes, notably through the setting up of joint projects.

Funding: part of OECD budget.

Members: 23 OECD member governments.

WMO (World Meteorological Organisation)

Established: 1947. *Location:* Geneva.

Aims: to facilitate world-wide co-operation in the establishment of networks of stations for the making of meteorological observations as well as hydrological and other geophysical observations related to meteorology; to standardise the publication of these observations and the promotion of rapid weather information services; to further the application of meteorology to aviation, shipping, water problems, agriculture and other human activities; to encourage research and training in meteorology.

Activities Include:

WWWP (World Weather Watch Programme), established 1968. Based on a system of world and regional centres promotes the high speed exchange of satellite and conventional data. The Global Data Processing System (GDPS) consists of a network of world, national and regional meteorological centres; the Global Observing System (GOS) consists of surface-based and space-based subsystems to provide meteorological data covering the whole globe; the Global Telecommunications System (GTS) consists of telecommunication facilities and arrangements for real-time exchange of observational and processed meteorological information.

WCP (World Climate Programme), established 1979, to promote the use of climate information in national and international activities concerning food, water and energy.

Instrumental in setting up/maintaining Intergovernmental panel on Climatic Change (IPCC), WCRP (with ICSU).

Members: 155 countries and five territories maintaining their own meteorological/ hydrometerological services.

Programmes promoted by NGOs and funded by participant bodies to meet the costs of their participation:

IGBP (International Geosphere-Biosphere Programme)

Established: 1986. (Joint programme of ICSU & WMO).

Aims: to describe and understand the interactive physical, chemical and biological processes that regulate the total Earth system, the unique environment that it provides for life, the changes that are occurring in this system and the manner in which they are influenced by human actions. A primary goal of the IGBP is to advance, through the improved understanding of the Earth System, our capability to predict changes in the global environment. The IGBP complements the WCRP, which addresses the physical aspects of the climate system.

Members: Australia, Canada, China, France, Germany, India, Japan, Senegal, Sweden, Switzerland, Venezuela, UK, USA, USSR.

IHP (International Hydrological Programme)

Established: 1975 (within UNESCO). *Location:* Paris.

Aims: to contribute to a better understanding of the hydrological system and facilitate the exploitation and better management of water resources. Provides a forum for programme development and assessment; promotes and encourages co-operative programme development.

Members: Council of 30 members elected at UNESCO General Conference.

IOC (Inter-Governmental Oceanographic Commission)

Established: 1960, within UNESCO. *Location: Paris.*

Aims: to promote marine scientific investigations and related ocean services, with a view to learning more about the nature and resources of the oceans through concerted actions of members. Co-ordinates international maritime research and services at intergovernmental level; develops observing systems; co-ordinates UN agency activities, training, education and mutual assistance in maritime sciences. Responsible for intergovernmental aspects of the oceanographic components of the WCRP.

Funding: UN, FAO, WMO, IMO and contributions from IOC member states.

Members: Governments of 117 countries.

JGOFS (Joint Global Ocean Flux Study)

Aims: to determine and understand on a global scale the processes controlling the time-varying

fluxes of carbon and associate biogenic elements in the ocean and to evaluate the related exchange with the atmosphere, sea floor, and continental boundaries; to establish strategies for observing, on long time scales, changes in ocean biogeochemical cycles in relation to climate change. Complements WCRP and IGBP programmes.

UK contribution: NERC (BOFS programme)

ODP (Ocean Drilling Programme)

Established: 1975.

Aim: to study the processes that determine the geology and evolution of the ocean lithosphere.

Members: Canada, France, Germany, UK, USA and a European consortium led by the ESF.

UK contribution: £2.7 million pa.

PSMSL (Permanent Service for Mean Sea Level)

Established: 1933. *Location:* Birkenhead.

Aims: to collect, analyse and publish data regarding changes in global sea-levels. Computer data bank holds a series of monthly and annual mean values of sea-level from over 1,300 stations. Identifies common trends and fluctuations on local and gobal scales; acts as sea-level data co-ordinator for special international projects.

Funding: by UNESCO, IOC and NERC.

WCRP (World Climate Research Programme)

Established: 1979, as the scientific component of the WCP (joint responsibility of WMO and ICSU).

Aims: to obtain a better understanding of climate change and variability and their causes, whether from natural or human influences (with particular emphasis placed on the controlling effect of cloudiness on the radiation energy budget of the climate system, and the effect of the physics and dynamics of the ocean on global cycles of heat, water and chemicals, especially carbon, in the climate system); to provide scientific guidance in those aspects of the programme that need international co-operation for their successful conduct; to facilitate the exchange of information among scientists responsible for carrying out the research at national and international levels. The WCRP complements the IGBP, which addresses the biological/chemical aspects of the earth system.

Activities include:

WOCE (World Ocean Circulation Experiment), which aims to measure and model the deep ocean in order to develop a better understanding of how ocean circulation changes and ameliorates the earth's climate; to find methods for determining long-term changes in the ocean; to gather data vital for modelling of global climatic change. Resources required for WOCE are of two categories: those that already exist in oceanographic science institutions; and resources which are not available by the normal funding mechanisms available to principal investigators. These later resources, which include satellites, a dedicated research ship, vastly improved computers for modelling, etc., were included as specific items in the WCRP Implementation Plan.

UK contribution (to WOCE): £1.9 million in 1990-91 (paid by NERC).

GEWEX (Global Energy Water Experiment), established 1988, to determine and model the global hydrological cycle and energy fluxes by means of measurements of observable atmospheric and surface properties; to determine the impact of the global hydrological cycle on the atmosphere and ocean; to foster the development of observing techniques, data management and assimilation systems suitable for operational application to long-range weather forecasts, hydrology and climate predictions. GEWEX includes a strong numerical model development programme.

Programmes Assigned Their Own Funds:

EC Framework Programme (II: 1988-92; III: 1990-94)

Aim: to maintain and strengthen the international competitiveness of European industry in high technology sectors by promoting cross-border co-operation, co-ordination and mobility between industry and science; supporting basic research; integrating research and technology into the concept of completing the single integrated market (this applies especially to standardisation, which often requires high levels of R&D).

UK contribution: £171 million in 1989-90.

The major components of the Framework Programme are:

ESPRIT (European Strategic Programme for Research and Development in Information Technologies).

Aims: to provide the European IT industry with the technological base needed to meet the

competitive requirements of the 1990s; to promote European industrial collaboration in pre-competitive R&D in IT; to develop internationally accepted standards. ESPRIT II places greater emphasis on market-orientated projects and technology transfer and the sectors for support have been consolidated into three areas: Microelectronics and peripherals, Information processing Systems and IT Application Technologies. Furthermore new emphasis has been placed on strengthening European capabilities in such areas as Application Specific Integrated Circuits (ASICS), high performance parallel processing computers and new office work stations. ESPRIT II also includes a new component, Basic Research Actions, designed to complement the main industrial programme.

Total Budget: 1,600 million ECU (1988-92).[1]

RACE (Research and Development in Advanced Communication in Europe)

Aims: to lay the foundations of the EC's communications infrastructure for the 1990s and into the 21st century, by combining the expertise of telecommunications researchers, manufacturers, administrators and broadcasting stations across European frontiers; to contribute to the introduction of Integrated Broadband Communication (IBC), taking into account the evolving Integrated Services Digital Network (ISDN) and national introduction strategies; to promote transnational collaboration in pre-competitive R&D; to contribute to new and improved information services; to prepare for international standards; to develop joint functional specifications for operators.

Total Budget: 550 million ECU (1987-92).

BRITE/EURAM (Basic Research in Industrial Technologies for Europe; European Research on Advanced Materials)

Aims: to strengthen the competitiveness of European manufacturing industry, including SMEs, in world markets; to establish the necessary technological base for the development of new products and processes. The new single programmes covers research projects in advanced materials technologies, design methodology and assurance for products and processes, application of manufacturing technologies and technologies for manufacturing processes.

Budget: 500 million ECU (1989-92).

BRIDGE (Biotechnology Research for Innovation, Development and Growth in Europe)

Aim: to strengthen the scientific basis of Europe's biotechnology and hence improve its international competitiveness; to provide cross-border research for the purpose of speeding up the production of the biological data, materials and processes necessary for the optimal use of natural organisms; to establish EC regulations for biotechnology.

Budget: 100 million ECU (1990-94).

CONTROLLED THERMONUCLEAR FUSION

Aim: Controlled thermonuclear fusion has the potential to provide a major source of energy for the next century that has the prospect of a limited impact on the environment and which would use primary fuels that are abundant in the EC. The aim of European fusion research is to lead, in due course, to the construction of prototype reactors with a view to their industrial production and marketing. Research is aimed at fully exploiting JET and several experimental fusion reactors and at establishing the physical and technological basis necessary for the detailed planning of NET. All European fusion research is integrated into one EC programme and is implemented by a series of Contracts of Association between EURATOM and the national organisations in member states active in fusion, by the JET Joint Undertaking, and through an agreement establishing the NET team. A small part of the European Joint Research Centre is also dedicated to fusion research. (see also JET).

Budget: 551 million ECU (1988-92).

JOULE (Joint Opportunities for Unconventional or Long Term Energy Supply)

Aim: to develop energy technologies that take account of new and renewable energy sources; to increase security of supply and reduce energy imports; to contribute to environmental protection. The sub-programmes of JOULE focus on energy conservation and storage, energy from fossil fuels and renewable and geothermal energy.

Budget: 122 million ECU (1989-92).

JRC (Joint Research Centre)

Established: 1957. *Location:* centres in Ispra, Italy; Geel, Belgium; Karlsruhe, Germany;

[1]1ECU = £1.35 (May 1990).

Petten, Netherlands.

Aims: the JRC carries out in-house research programmes wholly funded by the EC (known as "direct action"). The work is focussed on four main themes: safety, with particular reference to the nuclear energy industry; the environment; standards, measurement methods and reference materials; and advanced materials and testing.

SCIENCE (Scientific and Technical Co-operation)

Aims: to improve the efficacy of research in EC states and help reduce the scientific and technical disparities between them; to improve the general quality of scientific and technical research and development; to promote training through research; to improve the mobility of researchers in Europe; to establish a network of scientific and technical co-operation and interchange in Europe.

Budget: 167 million ECU (1988-92).

Programmes funded indirectly by member governments:

EUREKA

Established: 1985. *Location:* Brussels (small secretariat).

Aims: to encourage the competitiveness of European high technology industries. Projects are market led; their aim is to produce internationally competitive high technology products, processes and services, using the European market as a springboard. EUREKA is complementary to the EC Framework Programme, which concentrates more on pre-competitive R&D, and is co-ordinated by a Conference of Ministers and the EC.

Members: 12 EC states plus Austria, Finland, Iceland, Norway, Sweden, Switzerland, Turkey and the European Commission.

Budget: approximately 1,000 million ECU pa (£670 million).

UK co-ordinator: DTI.

3. Large centralised facilities

CERN (European Organisation for Nuclear Research)

Founded: 1954. *Location:* Geneva.

Aims: to promote European collaboration in high energy particle physics; to probe the innermost constituents of matter in order to obtain a better understanding of how the world and the universe works.

Members: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK. (EC, Poland, Turkey and Yugoslavia have observer status).

UK contribution (based on relative GDP): £49 million (1989-90), paid by SERC (16 per cent of total CERN budget).

EMBO, EMBC, EMBL (European Molecular Biology Organisation, Conference and Laboratory)

Aims: EMBO is a self-governing body of about 700 scientists, formed in 1963, to promote recognition and support of biology in Europe. EMBO awards fellowships and organises exchanges, courses and workshops. The funding countries interact through the EMBC and all but Belgium, Iceland and Ireland help fund the EMBL for fundamental research in molecular biology (located in Heidelburg, Germany).

Members: Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Israel, Italy, Netherlands, Norway, Spain, Sweden, UK.

UK contribution: £0.6 million pa (EMBC) and £2.6 million pa (EMBL), paid by MRC.

ESA (European Space Agency)

Established: 1975. *Location:* Noordwijk, Netherlands; Frascati, Italy; Darmstadt, Germany.

Aims: to provide for and promote, for peaceful purposes, European co-operation in space research, technology and applications. Members have to subscribe to the mandatory science and basic technology programme, which includes the Hubble Space Telescope, the Infrared Observatory and the Horizon 2000 programme, but decide their own contributions to the various elements of the optional programmes. The latter include Communications (ECS, MARECS), Earth Observation (ESR-1, ESR-2, ASTR), In-orbit Infrastructure (Spacelab, EURECA-1, Columbus Programme) and Space Transportation (Arianne).

Members: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, UK. (Finland is an associate member and Canada has an

agreement for close co-operation).

UK contribution: £87 million (1989-90), paid by DTI, SERC/DES. The UK contributes about 13 per cent of the ESA budget, representing about 67 per cent of UK Government spending on civil space R&D. In addition to the science and basic technology programme the UK has so far concentrated on the first two optional programme. UK participation described in detail, ESA p 314, DES p 120.

UK co-ordination: BNSC, SERC, DTI.

ESRF (European Synchrotron Radiation Facility)

Established: 1984 (phase one due for completion 1994)

Aims: to achieve a significant enlargement of the range of experiments possible through existing synchrotron radiation sources by means of enhanced brillance and extended energy range.

Members: Belgium, Denmark, Finland, France, Italy, Spain, Switzerland, Germany, Norway, Sweden, UK.

UK contribution: £3.8 million in 1989-90 (paid by SERC).

IARC (International Agency for Research on Cancer)

Established: 1965 by WHO. *Location:* Lyons.

Aim: to promote international collaboration in cancer research. IARC conducts research projects, educates and trains personnel, and collects and disseminates information.

Members: Governments of Australia, Belgium, Canada, Finland, France, Germany, Italy, Japan, Netherlands, Sweden, USA, USSR, UK. Members of WHO able to contribute effectively to the scientific and technical work of the Agency.

UK contribution: £0.6 million in 1989-90 (paid by MRC).

ILL (Institute Laue Langevin)

Established: 1967 (UK joined as third partner in 1973). *Location:* Grenoble.

Aims: the High Flux Beam Reactor (HFBR) and associated instruments provide a central facility for specialists from laboratories in partner countries to carry out research in nuclear and fundamental physics, chemistry, biology and materials science.

Members: France, Germany, UK. (Austria, Spain and Switzerland, as scientific members, each contribute 1.5 per cent of the annual budget).

UK contribution: £8.7 million in 1989-90 (paid by SERC).

ISIS (Spallation Neutron Source)

Established: 1985. Location: Rutherford Appleton Laboratory.

Aims: particle accelerator used for the study of liquids, solid state physics, metallurgy, crystallography, polymer science and biophysics.

Members: used by researchers from France, Italy, Netherlands, Sweden, other countries, UK.

Budget: 80 per cent funded by SERC.

JCMT (James Clerk Maxwell Telescope)

Aims: the 15m telescope on Hawaii provides the major Southern Hemisphere optical astronomy data for the UK. The telescope permits new areas of study in the relatively unexplored sub-millimetre region of the spectrum.

Members: Canada, Netherlands, UK (funded in ratio 25:20:55).

UK contribution: £1.0 million in 1989-90 (paid by SERC).

JRC (Joint Research Centre)

See EC Framework Programme.

JET (Joint European Torus)

Established: 1978. *Location:* Culham Laboratories, UK.

Aims: to obtain and study plasma in conditions and with dimensions approaching those needed in a thermonuclear reactor. Technological issues vital for the subsequent development of fusion reactors are being faced in JET.

Funding: Euratom (80 per cent), UKAEA (10 per cent), Euratom Contracts of Association (10 per cent).

LA PALMA OBSERVATORIES

Aims: the Issac Newton group of telescopes provide the major Northern Hemisphere optical astronomy data for the UK.

Members: Netherlands and UK (funded in ratio 1:4).

UK contribution: £1.0 million in 1989-90 (paid by SERC).

AAO (Anglo-Australian Observatory)

Aim: includes the 150 inch Anglo-Australian optical telescope; SERC's Schmidt telescope.
UK contribution: £1.3 million in 1989-90 (paid by SERC).

TMRBL (Tropical Medical Research Board Laboratories)

Aims: The Jamaica laboratory studies the clinical features and natural history of sickle cell disease and other problems of Caribbean interest. The Gambia laboratory works on problems of tropical diseases in West Africa. The laboratories receive support from the IARC, ODA, WHO, Family Health International and the Rockefeller Foundation.

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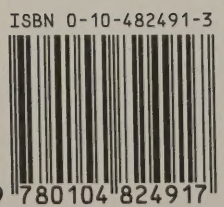

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